The Welding Engineer

Reg. U. S. Pat. Office

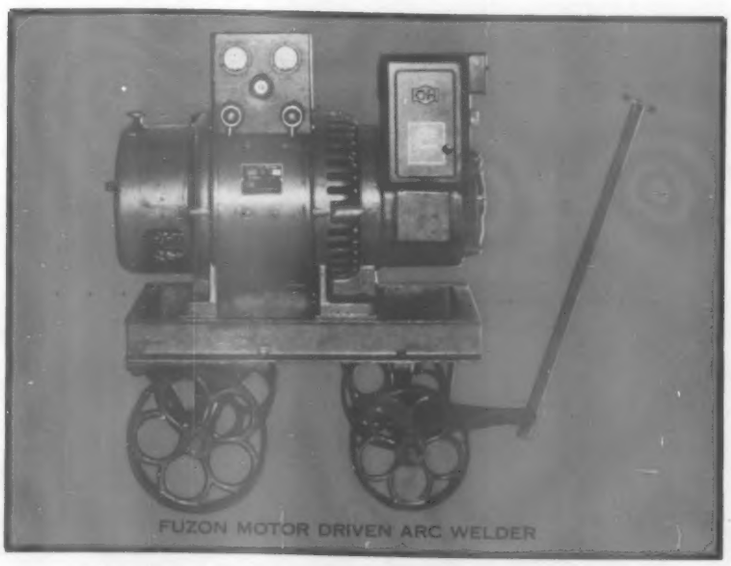
Founded by L. B. Mackenzie, 1916

OCTOBER, 1927 VOL. 12, No. 10

$3.00 per year in U. S. 608 S. Dearborn St., Chicago, Ill. $4.00 per year abroad

EQUIPMENT-SUPPLIES
FUZON
WELDING & CUTTING

lowest first cost



FUZON MOTOR DRIVEN ARC WELDER

lowest operating cost

No Exciter—No External Stabilizer—No Rheostat
—One Control—
Arc Flexibility Hitherto Unapproached—Welding Range Never Before Equaled
A Welder So Different It Merits Investigation

FUSION WELDING CORPORATION
Engineers — Manufacturers — Merchants

103RD STREET AND TORRENCE AVENUE
CHICAGO

Published monthly by the Welding Engineer Publishing Co. Entered as second class matter Jan. 20, 1916, at the Post Office at Chicago, Ill. Under the Act of March 3, 1897.

Linde can help you to stop the "*oxygen leaks*"

MORE than you realize. You sit down and study oxygen prices before you buy it. A few cents loom large in your eyes at that time. Then, when oxygen is shipped in to your storehouse, you probably forget all about it.

For one thing, you forget the oxygen valve in the top of the cylinder. It is the watchman of your oxygen supply. The Linde oxygen cylinder valve has a double seat. It prevents leaks whether it is open or closed. A glance at the diagram will show you why.

But more important still is the waste of oxygen in use. Linde service develops the most efficient and economical use of oxygen by every customer. Linde service men can show you how to conserve oxygen by proper process control. Linde procedure controls are detailed instructions for carrying out welding and cutting operations. They describe economical welding methods. They are free to Linde customers.

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Unit of Union Carbide and Carbon Corporation

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General Offices: Carbide and Carbon Building
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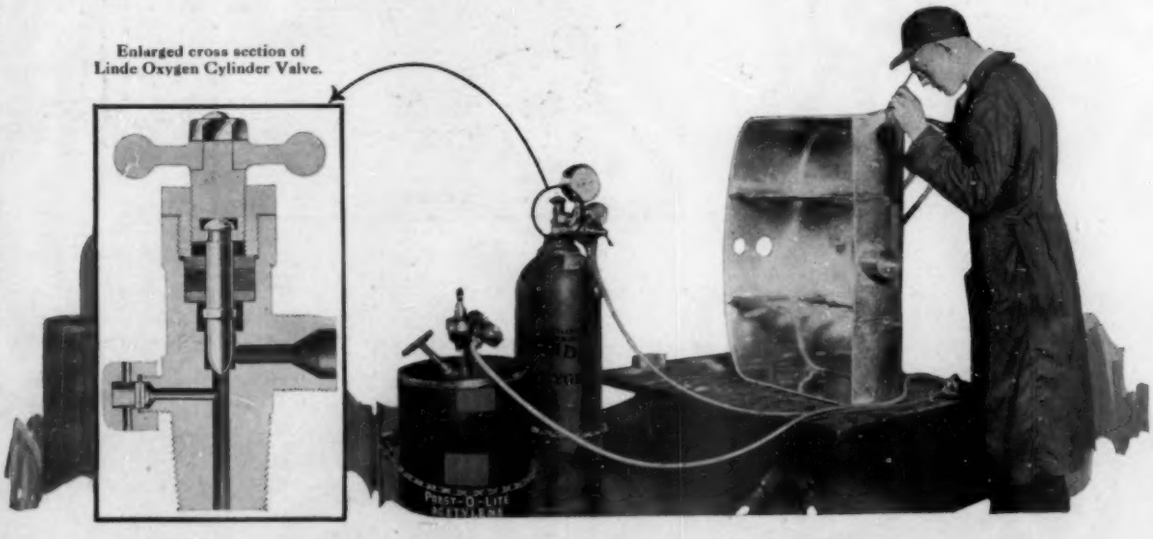

LINDE OXYGEN

This 4-ton Cast Iron Spur Gear Restored to Use by Oxyacetylene Welding and the Airco Assistance that is Available to Airco Customers—

with Airco Oxygen, Airco Acetylene and Airco-Davis-Bournonville Apparatus

THIS TAG IS ON EVERY AIRCO OXYGEN CYLINDER

Buy Your Oxygen On Specification for Purity

AIRCO OXYGEN IS 99.5% PURE IN THE CYLINDER

The Purest Oxygen Is Always the Most Economical

A four-ton gear with 18-in. face, 3-in. thick; 10-ft. diameter; two sections broken out of face, one 2-ft. long, the other 3-ft. long; one spoke broken close to hub, two spokes cracked close to face. Obsolete pattern and replacement only at great cost for new pattern, casting, and resulting delay. Reclaimed by oxyacetylene welding, two welders, and at times three helpers feeding added metal. Only the sturdiest torches could stand up on such heavy welding. Airco-Davis-Bournonville Style 7700 torches were used constantly, with Airco gases and Airco-D-B welding rods.

It is such performance that ensures reliance upon Airco products and Airco service to Airco customers, available from 64 Airco plants, 110 distributing points and 20 district offices.

AIR REDUCTION SALES COMPANY

Baltimore	Chicago	Emeryville, Calif.	Minneapolis	Richmond
Birmingham	Cleveland	Jersey City	Oklahoma City	Seattle
Boston	Dayton	Los Angeles	Philadelphia	St. Louis
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Home Office—342 Madison Ave., New York City, N. Y.

Portability

Repair jobs do not respect convenience. On one side of the plant there is a steam leak that must be stopped quickly by oxwelding. Or, a machine breaks on the other side of the plant. Again a hurry call for the welder. Time after time oxwelding equipment must be transported with speed.

Then the convenience of moving a cylinder of Prest-O-Lite dissolved acetylene becomes apparent. The WK cylinder contains about 270 cubic feet of gas and weighs much less than even the smallest welding type generator; the WC size (100 cu. ft. capacity) offers a still greater factor of portability. That is why cylinders are always used where portability is essential.

THE PREST-O-LITE COMPANY, INC.
Unit of Union Carbide and Carbon Corporation
UCC
General Offices: Carbide and Carbon Bldg., 30 East 42d St., New York
31 Plants — 101 Warehouses

Prest-O-Lite
DISSOLVED ACETYLENE

The Welding Engineer

Founded by L. B. Mackenzie, 1916

Volume 12 | October, 1927 | Number 10

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For Service to Industry

FOURTEEN advertising, publishing and allied group conferences and conventions were scheduled in Chicago for "Advertising Week," October 17th to 22nd, and prominent among the events of this great advertising program were the meetings of the Associated Business Papers, Inc., the Audit Bureau of Circulations, and the National Conference of Business Paper Editors. There is no better proof of how keenly these organizations feel their responsibility to the industrial world than a survey of the topics they have chosen for discussion. In some cases these groups have gone farther than simply writing their own conceptions of this responsibility, they have invited representative leaders of industry to attend their meetings and explain what nature of service is at present most in demand. The keynote of their own discussions is the matter of improving the service they already offer. The better class of trade and industrial publications, represented by the A. B. P. have for several years concentrated their association work in the direction of building business in the important industries to which they are devoted. The business paper reader who finds his favorite paper noticeably free from political and preferential influence may wonder why so little attention is paid to issues which have been selfishly represented to him as being vital issues. The answer is that there is never more than enough time and energy available to devote to the big constructive policies for which publishers of this class feel a prime responsibility.

Published on the 15th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,
608 S. Dearborn St., Chicago, Ill.
Telephone Wabash 7134

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T. E. DePew, Eastern Manager
Telephone, Columbus 6941

Subscription payable in advance and postage free.
United States and possessions and Canada ..... $3 a year
Foreign Countries ..... $4 a year
Single copy, domestic ..... 35 cents
Single copy, foreign ..... 30 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations and of the Associated Business Papers, Inc.

Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

Authorized Representatives

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DENVER—A. G. Odell, Public Opportunity School.
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AUSTRALIA AND NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand.
SOUTH AFRICA—J. W. Arnison, 35a Victoria Ave., Benoni, Transvaal, South Africa.

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Air Reduction Sales Co.
Commercial Acetylene Supply Co.
International Oxygen Co.
Prest-O-Lite Co.

ACETYLENE CYLINDERS
Keith Dunham Company
Pressed Steel Tank Co.

AIR LIQUEFACTION OXYGEN PRODUCING PLANTS
Keith Dunham Company
Heylandt Sales Co.

ALUMINO-THERMIC WELDING
Metal & Thermit Corporation

ALUMINUM SOLDER
Weldene Corporation

ANNEALING FURNACES
General Electric Co.
Westinghouse Elec. & Mfg. Co.

APRONS (Asbestos)
Ideal Face Shield Co.

ASBESTOS INSULATED WIRE AND CABLE
Central Steel & Wire Co.

BLOW PIPES
See "Torches."

BOOKS
The Welding Engineer Pub. Co.
Electric Arc Cutting & Welding Co.

BRAZING OUTFITS
Air Reduction Sales Co.
Burdett Oxygen Co.
Carbic Mfg. Co.
Craftsweld Equipment Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Alexander Milburn Co.
Modern Engineering Co.
National Welding Equipment Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Williams & Co.

BRONZE FILLER RODS
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Central Steel & Wire Co.
Krembs & Co.
Lincoln Steel Co.
Mueller Brass Co.
Steel Sales Corp.

BUFFERS
N. A. Strand & Co.

BUTT WELDERS
See "Electric Resistance Welders"

CABLE (Arc Welding)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Lincoln Electric Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Una Welding and Bonding Co.
U. S. L. Battery Corp.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CARBIDE
Air Reduction Sales Co.
National Carbide Co.
Shawinigan Products Corp.
Union Carbide Sales Co.

CARBON (Blocks, Paste, Electrodes, etc.)
Air Reduction Sales Co.
Burdett Oxygen Co.
Electric Arc Cutting & Welding Co.
Harris Calorific Co.
National Carbon Co.
Oxweld Acetylene Co.

CARBON BURNING EQUIPMENT
Air Reduction Sales Co.
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Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander Co.
Modern Engineering Co.
National Welding Equipment Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

CAST IRON SOLDER
Crown Aluminum Solder Co.
Weldene Corporation

CONSULTING ENGINEER
E. F. Hollinger
R. E. Kinkead

CONTRACT WELDERS
S. O. S. Welding Corp.

CUTTING ELECTRODES (Electric Arc)
Allan Mfg. & Welding Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Lincoln Electric Co.
National Carbon Co.
Una Welding and Bonding Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co.

CYLINDERS (Acetylene)
Keith Dunham Company
Pressed Steel Tank Co.

CYLINDERS (Oxygen, Hydrogen)
Wm. Wharton, Jr. Co.

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Stoody Company
N. A. Strand & Co.

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Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
General Electric Co.
Goodman Electric Machinery Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Lincoln Electric Co.
E. A. Lundy Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Stoody Co.
Una Welding and Bonding Co.
U. S. L. Battery Corp.
Welding Service Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRIC RESISTANCE WELDERS
Federal Machine & Welder Co.
General Electric Co.
Gibb Welding Machines Co.
Goodman Electric Machinery Co.
R. D. Thomas Co.

ELECTRODES (Carbon Arc Welding)
See "Cutting Electrodes"

ELECTRODES (Metallic Arc Welding)
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American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corporation
Koro Corporation
Lincoln Electric Co.
Page Steel & Wire Co.
Quasi-Arc Weldtrode Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Seneca Wire & Mfg. Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Seneca Electric Arc Welder Co.
Stoody Company
Una Welding and Bonding Co.
Welding Service Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE HOLDERS
Allan Mfg. & Welding Co.
American Steel Engineering Co.
Burke Electric Co.
Chicago Steel & Wire Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Koro Corporation.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Seneca Electric Arc Welder Co.
Una Welding and Bonding Co.
U. S. L. Battery Corp.
Welding Service Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.

ELECTRODE TIPS (Resistance Welding)
Elkon Works, Inc.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
International Oxygen Co.

FACE SHIELDS (Arc Welding)
Allan Mfg. Co. & Welding Co.
American Steel Engineering Co.
Burke Electric Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
Electric Welding Machine Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Stoody Company
Strauss & Buegeleisen
Una Welding and Bonding Co.
U. S. L. Battery Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

FILLER RODS
Air Reduction Sales Co.
American Brass Co.
American Steel & Wire Co.
Atlas Foundry Co.
Central Steel & Wire Co.
Craftsweld Equipment Co.
Oxweld Acetylene Co.
C. H. Hollup Corp.
Imperial Brass Mfg. Co.
Krembs & Co.
Mueller Brass Co.
National Welding Equipment Co.
Koro Corporation
Page Steel & Wire Co.
Reid-Avery Co.
Roebling, John A., Sons Co.
Seneca Wire & Mfg. Co.
Standard Steel & Wire Co.
Steel Sales Corp.
Stoody Co.
Stulz-Sickles Co.
Torchweld Equipment Co.
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

FIREPROOF PLASTIC MATERIAL
Air Reduction Sales Co.
Joseph Dixon Crucible Co.
National Carbon Co.
U. S. Welding Co.

FLUE WELDERS (Electric)
General Electric Co.

FLUXES
Air Reduction Sales Co.
Anti-Borax Compound Co.
Metal & Thermit Corp.
Central Steel & Wire Co.
Krembs & Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
Weldene Corporation
Weldit Acetylene Co.

GAS SAVING DEVICES
Harris-Calorific Co.
U. S. Welding Co.
Weldit Acetylene Co.

Part of the 40 tons of Wilson Welding Wire awaiting shipment to Manchuria, China, for the Baldwin Locomotive Works.

"Color-tipt"

Trade Mark Reg.
U. S. Pat. Off.

Insisted Upon *for* Repairs *in* Far-Away China

A large trans-continental railway in Northern Manchuria was recently faced with a series of vital repair jobs—so far away that the welding wire selected had to be absolutely dependable. They knew from long experience that they could trust Wilson "Color-tipt" Welding Wire anywhere, and forty tons were sent in one shipment to Manchuria.

The above is a Wilson Type S Single-Operator Motor-Driven Electric Welding Machine—designed for both production and repair work, and adapted for use wherever power is available. Its capacity is 25 to 300 amperes. Other Type S Machines include both single and two-operator units—gasoline-engine-driven, belt-driven and motor-driven—portable and stationary. Capacities: 25-250, 25-300, 25-600 amperes.

In every part of the world—in practically every industry—you will find Wilson Wire used where enduring strength in a weld is essential. Yet the superiority and economy of Wilson Wire are not confined to welds of paramount importance. After all, any welding worth doing is worth doing *right*. That requires perfect uniformity in the welding wire. And that is what Wilson Wire is noted for.

Every grade (analysis) of Wilson Wire runs uniform throughout—every rod is just like every other rod of the same grade. And there is a grade for each kind of metal—for the particular metal you are welding—for *your* particular industry. Each grade is designated by a color.

Write today for a sample of Wilson Wire—just indicate the kind of welding you wish to do. Also, ask for bulletins describing Wilson Welding Machines.

WILSON WELDER & METALS CO. INC., WILSON BUILDING, HOBOKEN, N. J.

WILSON

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GAUGES
Moto Meter Co.
National Gauge & Equipment Co.

GENERATORS (Acetylene)
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Craftsweld Equipment Co.
M. Keith Dunham
Imperial Brass Mfg. Co.
Milburn, Alexander Co.
Modern Engineering Co.
Oxweld Acetylene Co.
U. S. Welding Co.

GOGGLES
Chicago Eye Shield Co.
Ideal Face Shield Co.
Strauss & Buegeleisen
Willson Goggles, Inc.

GRAPHITE (Rods, Blocks, Paste, Etc.)
Joseph Dixon Crucible Co.

GRINDERS (Portable Electric)
Stoody Company.
N. A. Strand & Co.

HELMETS (Arc Welding)
Allan Mfg. & Welding Co.
Burke Electric Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co
Electric Welding Machine Co.
Fibre-Metal Products Co.
General Electric Co.
Gibb Welding Machines Co.
C. H. Hollup Corp.
Ideal Face Shield Co.
Lincoln Electric Co.
Northwestern Mfg. Co.
Owen Electric Mfg. Co.
Quasi-Arc Weldtrode Co.
Seneca Electric Arc Welder Co.
Strauss & Buegeleisen
U. S. L. Battery Corp.
Waters Arc Welding Corp.
Westinghouse Elec. & Mfg. Co.
Williams & Co.
Wilson Welder & Metals Co.
Willson Goggles, Inc.

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Carl A. Norgren Co.
See also under "Needle Valves"

HYDROGEN
Burdett Oxygen Co.
Gas Products Association
International Oxygen Co.

HYDROGEN GENERATING PLANTS
International Oxygen Co.

LEAD WELDING UNITS
Air Reduction Sales Co.
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Harris Calorific Co.
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International Oxygen Co.
K-G Welding & Cutting Co.
Modern Engineering Co.
Milburn, Alexander Co.
National Welding Equipment Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.
Weldit Acetylene Co.

LIGHTERS (For Gas Torches)
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International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Stevenson Distributing Corp.
Torchweld Equipment Co.
U. S. Welding Co.

MANIFOLDS
Air Reduction Sales Co.
Burdett Oxygen Co.
Craftsweld Equipment Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

MECHANICALLY OPERATED CUTTING AND WELDING TORCHES
Air Reduction Sales Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.

MOLDING MATERIAL
See "Fire Proof Plastic Material"

MONEL METAL RODS AND ELECTRODE
Central Steel & Wire Co.
Wilson Welder & Metals Co.

NEEDLE VALVES
Air Reduction Sales Co.
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Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

NITROGEN
Air Reduction Sales Co.
Gas Products Association
Linde Air Products Co.
International Oxygen Co.

OXYGEN
Air Reduction Sales Co.
Burdett Oxygen Co.
Gas Products Association
International Oxygen Co.
Linde Air Products Co.

OXYGEN PRODUCTION PLANTS
Keith Dunham Company
Heylandt Sales Co.

PREHEATING DEVICES AND OVENS
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Metal & Thermit Corp.

RAIL BONDS
Una Welding and Bonding Co.

RAIL JOINT WELDERS
Una Welding and Bonding Co.

REAMERS (Portable Electric)
N. A. Strand & Co.
Wodack Electric Tool Corp.

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Craftsweld Equipment Co.
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Imperial Brass Mfg. Co.
International Oxygen Co.
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Stoody Company
Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

SEAM WELDERS
See "Electric Resistance Welders"

SPOT WELDERS
See "Electric Resistance Welders"

TANK CONNECTIONS
Air Reduction Sales Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Oxweld Acetylene Co.
Torchweld Equipment Co.
U. S. Welding Co.

THERMIT WELDING
Metal & Thermit Corp.

TORCHES (Welding and Cutting)
Air Reduction Sales Co.
Burdett Oxygen Co.
Craftsweld Equipment Co.
Harris Calorific Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Milburn, Alexander, Co.
Modern Engineering Co.
National Welding Equipment Co.
Oxweld Acetylene Co.
Stoody Company
Torchweld Equipment Co.
U. S. Welding Co.
Welding Service Co.
Weldit Acetylene Co.
Williams & Co.

TRUCKS (Cylinder)
Air Reduction Sales Co.
Imperial Brass Mfg. Co.
International Oxygen Co.
Torchweld Equipment Co

VALVES
Air Reduction Sales Co.
Burdett Oxygen Co.
International Oxygen Co.
Kerotest Mfg. Co.

WELDING COMPOUND (for Shape Welding)
Air Reduction Sales Co.
Harris Calorific Co.
Joseph Dixon Crucible Co.
Modern Engineering Co.
National Carbon Co.

WELDING ROD HOLDERS
C. Sorensen

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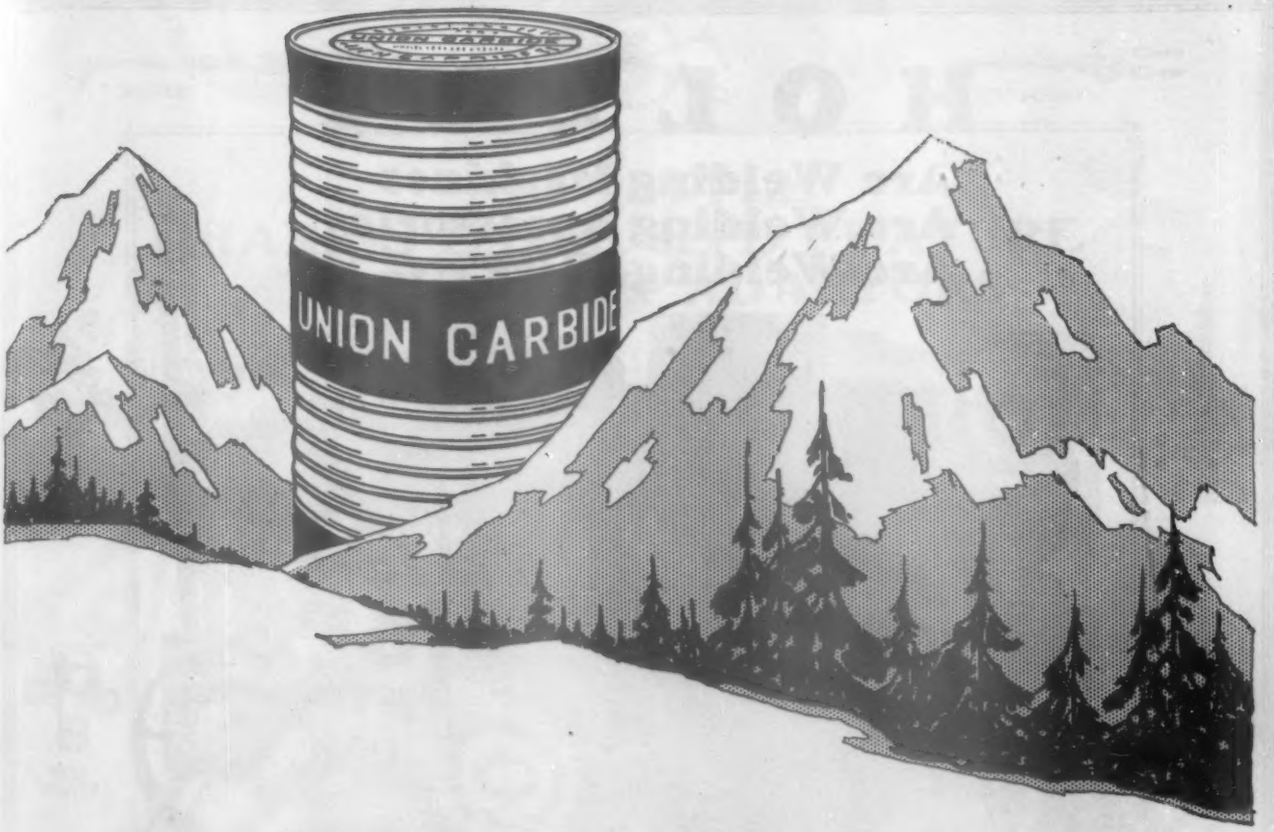

Uniform Quality Carbide

THERE is a real and thoroughly practical reason back of the statement that Union Carbide gives the highest uniform gas yield.

It is this.

No matter how carefully production is controlled, there is some variation in the grade and sizing of carbide. But only the highest quality carbide, that which conforms to most rigid specifications, is shipped to Union Carbide customers in blue and gray drums.

The Union Carbide Company has extensive and unrivaled facilities for using that carbide which doesn't conform to blue and gray drum carbide standards.

This means that Union Carbide customers get only the carbide with the highest uniform gas yield. It means that every pound of Union Carbide, packed into the blue and gray drums, will give the user greatest return on his investment.

UNION CARBIDE SALES COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

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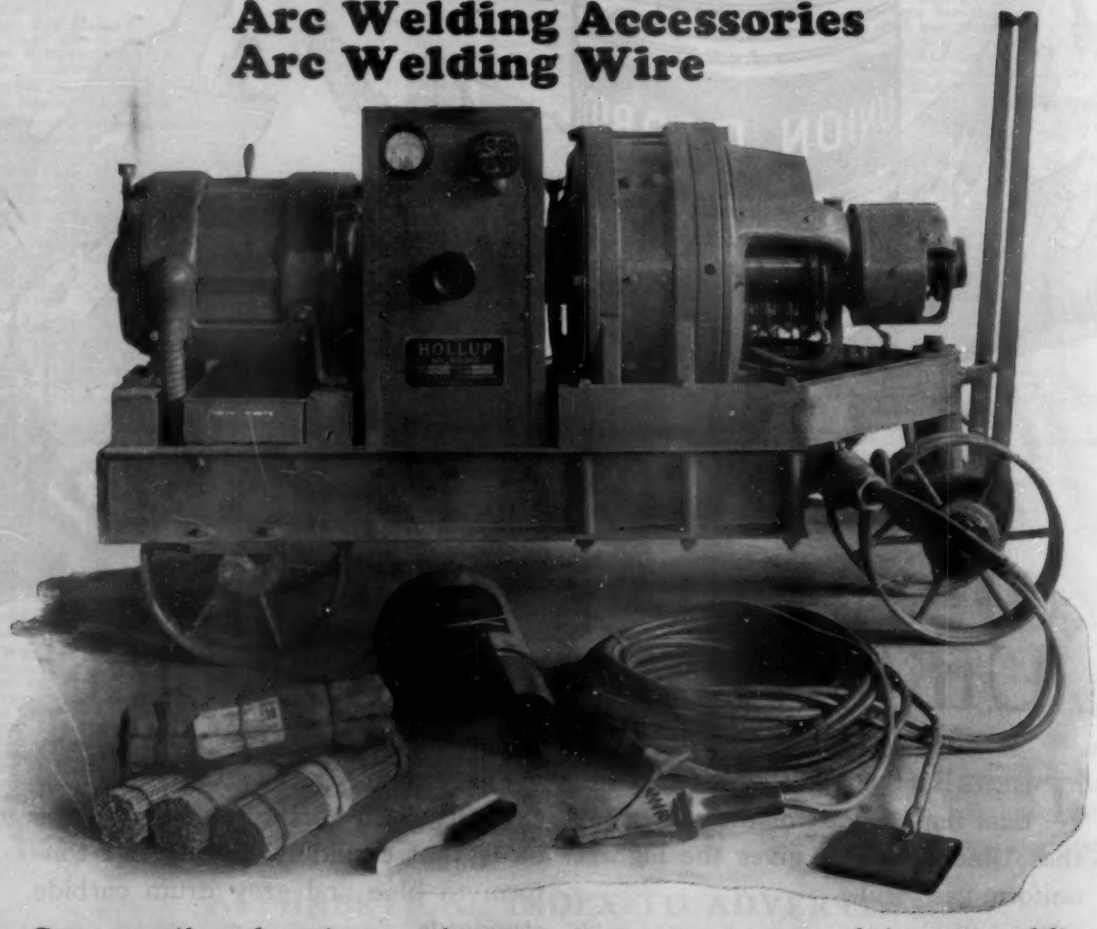
Peoples Gas Building, Chicago, Ill. *Adam Grant Building,* San Francisco, Cal.

UNION CARBIDE WAREHOUSES IN 190 CITIES

HOLLUP

Arc Welding Machines
Arc Welding Accessories
Arc Welding Wire



Steam railroads, who are the most important users of the arc welding process, generally determine their welding wire standard by extensive laboratory and service tests.

This is because their service conditions are extraordinarily severe and because reliability and safety must be assured.

Hollup welding wire is used by twenty-six steam railroads, which operate 78,500 miles of track, 15,983 locomotives and 572,824 freight cars, and which use this welding wire to maintain and keep the above equipment in service.

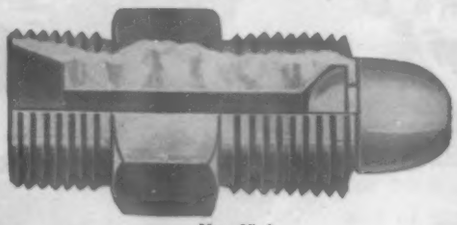
C. H. Hollup Corporation

3333 W. 48th Place **CHICAGO**

Arc Welding Specialists

Exclusively engaged in the manufacture of arc welding equipment and a complete line of welding wire for different purposes. In addition, the C. H. Hollup Corporation offers a competent engineering service by a staff of specialists thoroughly experienced in all practical applications of the process.

NEW STYLE HARRIS EXCLUSIVE FEATURE REGULATOR ADAPTORS



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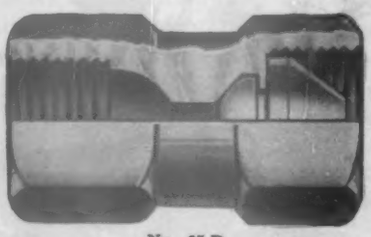

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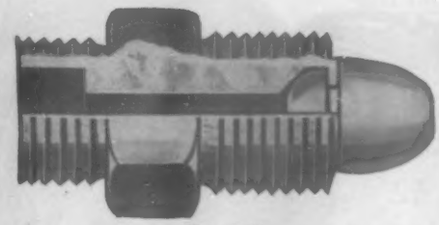

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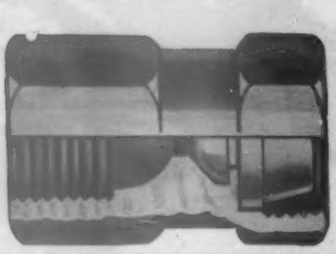

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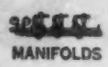
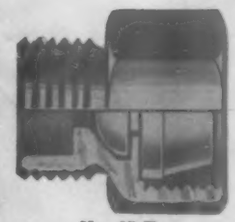


Immediate popularity arose from a recognition of their outstanding improvements:

1—Compactness
2—Solderless
3—Absolutely Leak-Proof
4—Strength



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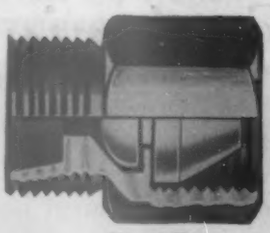


No. 65-F

Used to connect Regulators to gas cylinders with different fittings

Connection on Regulator	Fitting Wanted	
No. 65-A—Prest-O-Lite Lighting Tank	Prest-O-Lite Welding Tank	$1.00
No. 65-B—Commercial or Airco	Prest-O-Lite Welding Tank	$1.00
No. 65-C—Prest-O-Lite Welding Tank	Prest-O-Lite Lighting Tank	$1.00
No. 65-D—Prest-O-Lite Welding Tank	Commercial or Airco	$1.00
No. 65-E—Commercial or Airco	Prest-O-Lite Lighting Tank	$1.00
No. 65-F—Prest-O-Lite Lighting Tank	Commercial or Airco	$1.00
No. 65-G—Left Hand Linde	Left Hand Commercial (Not Shown)	$1.00
No. 65-H—Left Hand Commercial	Left Hand Linde (Not Shown)	$1.00

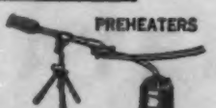
***NOTE PRICES* and specify HARRIS New Style Adaptors when in need**

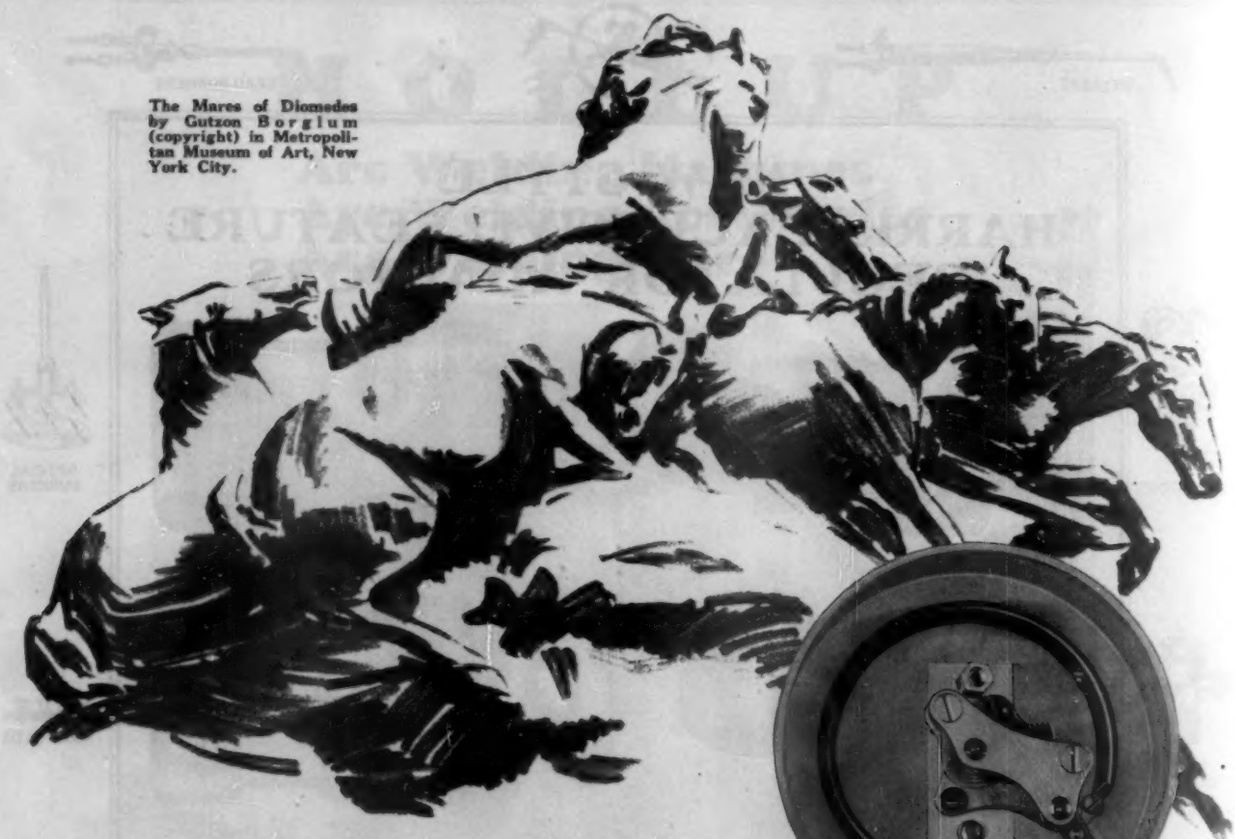
THE HARRIS CALORIFIC COMPANY

"The Most Complete Line in America"

2828 Washington Avenue, Cleveland, Ohio

With which is now merged the U. S. Welding Co., formerly of Minneapolis, Minn.





The Mares of Diomedes by Gutzon Borglum (copyright) in Metropolitan Museum of Art, New York City.

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Natweld Gauges cost no more, for volume production, made possible by the demand for a quality product has brought its price to an extremely low level.

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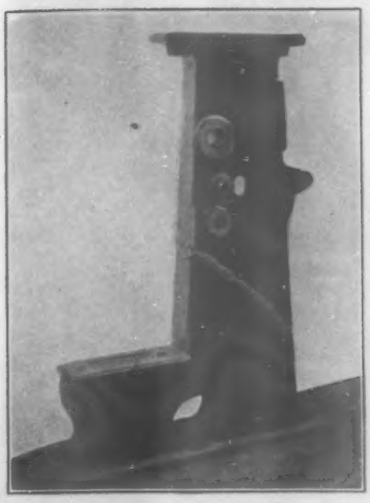
La Crosse, Wisconsin
A Division of the MotoMeter Co., Long Island City, N. Y.

The MotoMeter Co. of Can. Ltd., Hamilton, Ontario
Chicago Office: 820 Tower Ct.
Represented in Illinois, Indiana, Wisconsin, Minnesota and Missouri
By Joseph Halla, Chicago, Illinois

NATWELD GAUGES

"Known throughout the World, and used for Rivetless Construction by the leading engineers, industrial corporations, and shipbuilders everywhere"



Quasi-Arc Electrodes for Cast Iron put this paper making machine standard back into service in a few hours.

Quasi-Arc

Quasi-Arc is the scientifically designed Electrode which renders the fusion process uniform and easy to operate, and deposits a pure, homogeneous, fine grained metal of high physics, resisting shocks, vibrations, heat and corrosion practically in the same degree as the constructional steel.

Quasi-Arc welded JOINTS are therefore to be calculated for high stresses, thus reducing the area of section of joint and of construction material, and consequently—

Quasi-Arc welded CONSTRUCTIONS are low in weight and manufacturing costs, as well as unexcelled in quality.

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SERVICE

Quasi-Arc *Service means: Expert technical assistance in solving your welding problems and the instruction of your operators in the correct application of the Electrodes, with periodical supervision.*

HYDRO-ELECTRIC PIPE LINE WELDED THROUGHOUT WITH "QUASI-ARC" ELECTRODES. (Japan)

QUASI-ARC INCORPORATED

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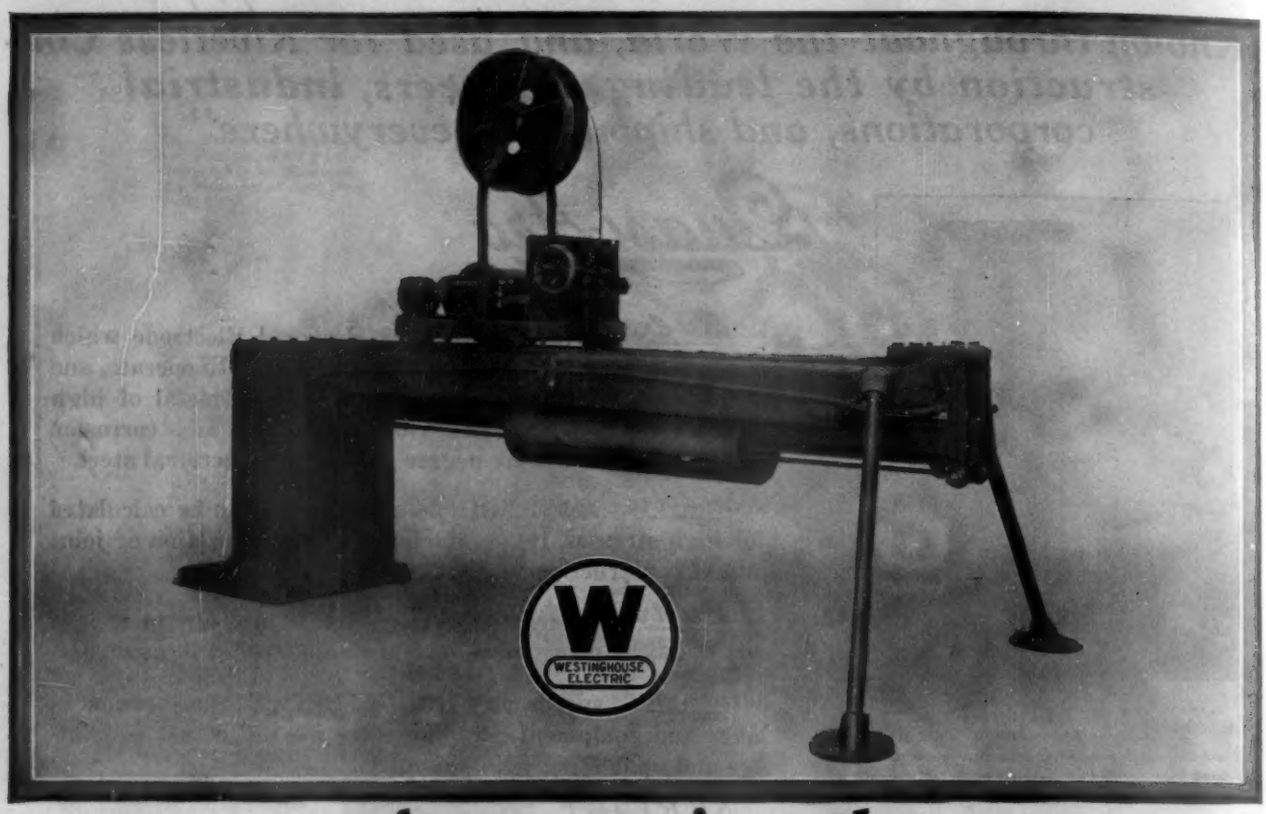

Announcing the Westinghouse Automatic Seam Welder

THE Westinghouse Automatic Seam Welder is the result of many important Westinghouse welding developments that will permanently establish Automatic Arc Welding as a production process.

This machine is adaptable for welding longitudinal seams in tanks, pipes and drums. Its outstanding characteristics are:

SIMPLICITY—It is only necessary to clamp the rolled piece in place and push the button. The Auto Arc will immediately strike and continue to weld.

UNIFORMITY OF WELD—Maintains constant arc length and proper speed of feeding the welding wire to the arc.

WIDE RANGE OF WORK—Will handle sheet steel from 16 gauge to 3/8 inch in thickness at welding current from 140 to 300 amperes. Work varying from 10 to 40 inches in diameter can be handled, and the maximum length of work is 8 feet. Additional designs, however, are available for larger diameters and greater lengths.

ECONOMICAL—Has speed from 7 to 30 inches a minute, thereby reducing cost, increasing production, and giving more uniform product.

A request for details will bring complete information regarding the characteristics of this machine.

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East Pittsburgh Pennsylvania

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X30530

and last but not least
G-E Welding Electrodes

General Electric service begins when you tap the power line and continues until the weld is made. That service must be good—from start to finish. There can be no dodging responsibility. Machine, accessories, and electrode must operate equally well.

You will find G-E Welding Electrodes upholding their part in the complete service General Electric offers to users of arc welding.

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Type "B" is best for automatic welding. The concentrated arc confined by encasing the flux around the core in a sheath, gives remarkable penetration for higher speed welding.

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In absolute reliability of operation and over-all efficiency, G-E Arc Welders are unequalled. They are available in all sizes, all types—for either hand or automatic operation—for one or more operators.

Special distributors for G-E Welding Electrodes located throughout the country are equipped to give you prompt service. Get in touch with the G-E Welding Electrode Distributor near you or write to the Merchandise Department, General Electric Company, Bridgeport, Connecticut.

550-21

GENERAL ELECTRIC

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Meco WELDING TORCHES

Approved by the Underwriters

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The Man Who Wins!

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LINCOLN ARC WELDING PRIZES FOR 1927

1st Award	- -	$10,000
2nd Award	- -	$ 5,000
3rd Award	- -	$ 2,500

This competition is to be judged by the American Society of Mechanical Engineers and complete information regarding the contest can be obtained from the society headquarters.

Briefly stated, these awards are to be given for the best papers describing applications of arc welding which will result in the greatest good for humanity. Anyone, in any country of the world, may compete.

For a booklet describing the conditions governing the award of these prizes, address the American Society of Mechanical Engineers, 29 West 39th Street, New York City, or the Lincoln Electric Company, Cleveland, Ohio.

To the WELDING INDUSTRY

WE HONESTLY BELIEVE THAT

"RACO" WELDING RODS

ARE THE FINEST QUALITY RODS ON THE MARKET TODAY

WE manufacture bare electric welding rods of both Pure Iron and Mild Steel analysis. We do not recommend bare rods for electric welding. We believe that the manufacture of a good electrode only starts with a bare wire. However, as large quantities of bare electrodes are used throughout the country, we supply them to those who desire this class of material.

We believe our oxy-acetylene welding rods are the most perfect rods of this type on the American market. They are manufactured from steel and iron made expressly for the purpose. These wires are drawn and copper coated under the direct supervision of our Wire Drawing Superintendent, who has been drawing this type of wire for twenty-five years in France, Italy and Switzerland. The extremely high quality of material used and finish make it a pleasure to use "RACO" gas welding rods.

For electric welding we recommend Raco Composite Electrodes. These rods are used equally well with either A. C. or D. C. current. This rod was originally developed for automatic welding where bare wire will not function due to great speed in welding and high amperage used. The Composite Rod is recommended for all work where bare and covered electrodes have previously been used. Greatly increased speed and far better penetration is secured and absolute uniformity of rods throughout an order is absolutely guaranteed. A special flux of truly wonderful characteristics is inlaid in the lengthwise grooves the entire length of the wire. The flux is protected in the grooves and cannot chip out, even when the wire is bent flat against itself. The accurate depth of the grooves automatically regulates the correct amount of flux needed.

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Our Company specializes in drawing welding wire only. We have no other interests and can give our welding rods our undivided attention.

Raco Welding Rods are fairly priced and we are able to give real service from our new plant at Dundalk, Maryland.

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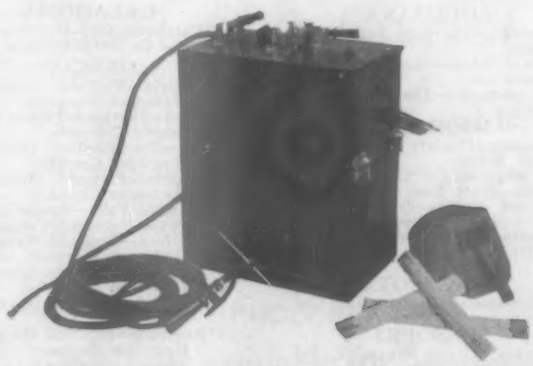
The "OWEN" produces highest quality welds and gives maximum secondary, or welding, amperage for the amount of primary power consumed.

Each machine is guaranteed to be free from defective workmanship and materials.



No moving parts. *Nothing to get out of repair.*
Really portable. *Easy to operate.*
No complicated mechanism.

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Fayetteville, North Carolina

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†*Santa Barbara — California Compressed Gas Co.
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Logansport—Logansport Oxygen Co.
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IOWA
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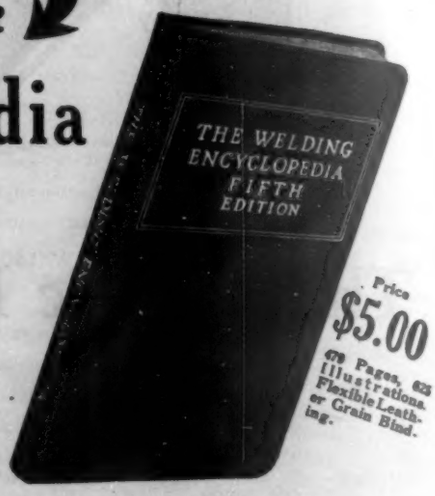
Fifth Edition



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678 Pages, 625 Illustrations. Flexible Leather or Grain Bind.

It describes in detail the theory and practice of every welding process. It tells how to weld every weldable metal by each of the welding processes. It gives detailed instructions for handling the important welding jobs, such as boiler welding, sheet metal welding, tank welding, pipe welding, etc. It tells how to prepare parts for welding. It tells how to install and care for welding equipment. It explains the meaning of all words and terms found in welding literature. It tells where to buy all standard makes of welding apparatus and supplies.

Contents

1. Illustrated encyclopedia covering all words, terms, and trade names used in welding.
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3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
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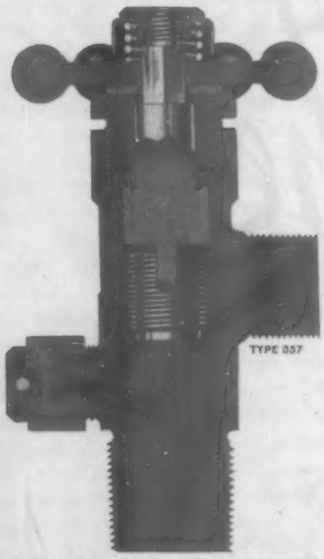

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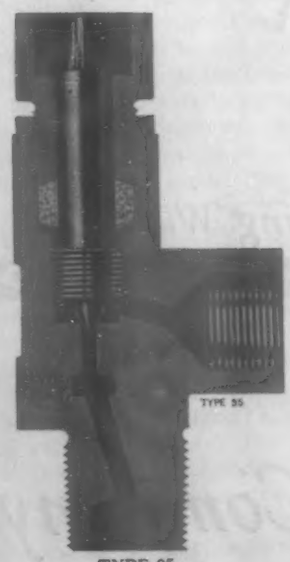

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EDITORIAL

Hundreds of New Manufacturing Ideas

THE scope, size and consequent importance of the New York Power Show to be held from December 5th to 10th, compels the attendance of every American manufacturer with his technical staff to glean from this comprehensive mechanical exhibition the kernals of information that will save him many dollars in operating expense. Every American manufacturer faces a daily crisis—the one demanding increased production and decreased costs. Through this critical situation he relies on the development of new machines and new methods for the saving of time, effort and money. American industry is on its mettle today as never before and its leaders are availing themselves of every scrap of information about new mechanical equipment that can be put to work in any corner of the factory. The manufacturers of the United States have been uniformly successful in meeting rapidly changing conditions. New equipment and methods are scrapped freely if a replacement offers increased production or reduced cost. The coming Power Show is the sixth of the series and promises the greatest success, which is easy to understand in a country which puts such a premium on novelty and improvement. But the coming event is of greater importance than its predecessors for this exposition gives under one roof an unsurpassed opportunity to study all the types of mechanical equipment that American manufacturing may use to advantage. Over 500 concerns will be represented and their showing will include those of machinery for power generation, heating and ventilating, refrigerating for large industries and office buildings. There will be many displays for measuring and recording time, pressure and volume. There will also be outstanding examples of modern machine shop equipment material and woodworking machines and an especially noteworthy collection of exhibits of power transmission equipment. With this splendid collection of devices of all kinds the manufacturer will find sufficient to keep him and his technical staff busy for several days analyzing with a view to adopting devices to his own plant and his own conditions. If he is a manufacturer of shoes or typewriters and his power costs are not a large percentage of his manufacturing cost he will still find a tremendous amount of valuable assistance in the exposition. He may be able to revise his entire manufacturing process by a study of the equipment that will be shown, he may be able to reduce the maintenance of his plant or he may find unexpected methods of cutting production costs.

The Detroit Show

APPROVAL of the plan to hold next year's Annual Fall Meeting of the American Welding Society and the Welding and Cutting Exposition along with it, coincident with the Annual Meeting of the American Society for Steel Treating, at Philadelphia next Fall, is a clear indication that the arrangement made this year has turned out to be the most satisfactory method of conducting a complete welding exposition during each Fall season. The show at Exhibition Hall in Detroit was a very comprehensive one and undoubtedly a great many of those who went to the Hall did not manage to see everything that was to be seen. But it is equally certain that the combined attraction furnished for the welding exposition a bigger and better attendance than it could have secured in any other way. It was also an advantage to many of the exhibitors to be able to cover two events with one booth. The experience of the exhibitors at the Detroit show seems to point to an increase in interest in all of the welding processes on the part of many industrial executives and also an increase in the actual knowledge of the processes which they have. It is quite evident that the educational work being done throughout the welding industry is having its effect. It is also gratifying to notice that the public generally wants to know more about these processes. The variety of instructive demonstrations at Detroit has done much to stimulate the growth of the industry. There can be little question of this.

"You Can't See Through a Glass Eye"

A MANDATORY ruling requiring every employee in an industrial shop to wear goggles while at work was advocated in Chicago by Harry Guilbert, Director of Safety of the Pullman Company, in an address before a joint session of the National Safety Council and the National Committee for the Prevention of Blindness. Addressing safety engineers, industrial physicians, oculists and others concerned with the prevention of blindness who gathered for the first national conference on this subject, Mr. Guilbert revealed that such a mandatory rule is enforced in all the repair shops and yards of the Pullman Company, and that as a result, the eyes of approximately a thousand of their men have been saved from serious injury or destruction.

As indications of the economic reasons for drastic measures to prevent industrial eye injuries, Mr. Guilbert declared: "In Pennsylvania alone the sight of 6,842 eyes has been completely destroyed in industrial accidents since 1916. From January 1st, 1927, to date, 383 eyes have been made useless through accidents in the industries of Pennsylvania ranging from coal mining to restaurant work. In one year the employers of Pennsylvania paid more than $800,000 in compensation for eye injuries and this represents a total ecenomic loss of close to $5,000,000.

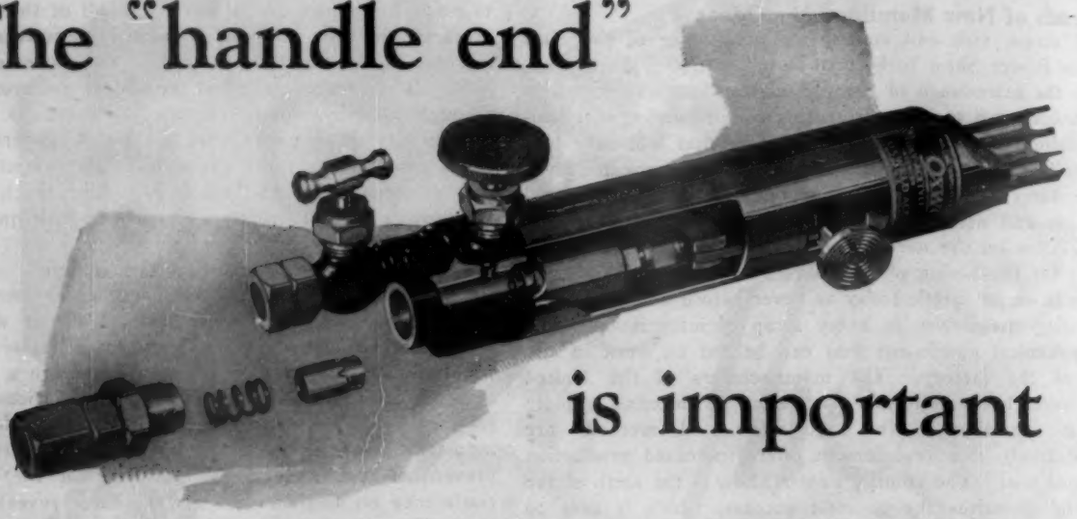
"The most difficult part of safety engineer's job is to persuade workmen to protect their most valuable asset—their sight. The repair shops of the Pullman Company are the only shops where goggles are worn universally, from president down to office boys or visitors who may come into the plant for just a few minutes. This has been accomplished in the face of ridicule, opposition, ignorance, indifference and the lack of cooperation on the part of the workmen themselves.

Describing the result of the examination of the eyes of 4,000 men in the shop of the Pullman Car and Manufacturing Corporation, Mr. Guilbert said 1,139 of them, or 28 per cent, had normal vision in both eyes without glasses; 1,539, or 38 per cent, had normal vision in both eyes when they wore glasses; and the remaining 1,322, or 34 per cent were found to have defective vision; 696 of the 4,000 men examined or 17 per cent were found to have only 5 per cent of normal vision, in many cases as the result of early eye injuries.

"In the Pullman Company," Mr. Guilbert said, "we have spent about $75,000 for eye protection. No sane person will question this expenditure because it prevents loss of sight and saves money; it means better work and more of it; it inspires our workmen with confidence, for they can go about their duties without fear of flying slivers of steel, hot metal or splinters of wood.

"Let the person who declines to wear goggles in an industrial plant consider this one fact; 40,000 glass eyes are imported by the United States each year; they are works of art and sometimes hard to distinguish from the real thing; they are good to look at, but impossible to look through. You can not see a thing with a glass eye."

The "handle end"



is important

ASK a cutter why he likes the Oxweld cutting blowpipe. One thing he always mentions is the oxygen valve. It works easily (it works *with* the gas pressure, not against it) and is easy to replace.

Any valve in constant use will wear out and need adjustment. Every mechanic knows that. So the Oxweld cutting blowpipes are all designed with a standard valve mechanism. The valve is as easy to replace as an automobile tire valve—one nut to unscrew and the valve can be slid out, adjusted or replaced.

It is but one of the indications that Oxweld equipment is practical, designed by men who know welding and cutting and build it for service.

That's why Oxweld is ahead of the field.

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Economy Throughout, in Construction Cost, Maintenance Cost and Floor Space, Is the Distinguishing Feature of This New Type of Hydraulic Press.

Welded Press Has 1000-Ton Capacity

Old Ideas of Using Cast C-Frames Entirely Abandoned— New Type Welded Steel Frame Shows 66% Saving in Cost

WHEN the Pacific Steel Boiler Corporation needed a new heavy-duty hydraulic press, conventional designs for such a press were discarded and an entirely new and unique construction was devised in order to take the fullest advantage of the strength and economy of welded joints.

It is obvious at once to a visitor at the Pacific Boiler plant that here welding is taken as a matter of course. Wherever two pieces of metal are to be joined, whether in a boiler seam, a pipe connection, or the steel frame for a new shop, welding is invariably called upon to do the job. Furthermore, it has been this company's experience that a welded job "once done stays done." It was consequently quite logical that in designing the new hydraulic press, and other still larger ones that followed, that engineers should specify welded joints throughout this massive structure, with its tremendous bending, shear and tension stresses.

The complete press, of 1,000-ton capacity, weighs 70 tons, and is operated by hydraulic pressure of 1,700 pounds per square inch. It is used in forming 3/8 inch steel boiler plate for fire-box walls. The end view of the cast iron dies in Fig. 1 shows the nature of the bends formed by the press. The left-hand set of platens on this double press forms a single bend, while the other set forms a double bend, with one acute and one obtuse angle as shown at the top of the side wall in Fig. 2. Both sides of the press can be operated simultaneously, though each press has its own control valves. These valves and the operating levers, together with some of the welded pipe joints and bends, can be seen in Fig. 3.

All of the pipe joints in the extensive 2-inch and 4-inch underground system, as well as the large headers, are welded on account of their inaccessibility in case of leakage.

Much material and labor, as well as floor space, was saved in building the two presses in one double "C-Frame." With this construction each side serves to reinforce the other, whether operating independently or in unison. The time and handling required for this operation are also reduced by having the two presses, which bend angles in the same sheet, located within a few feet of each other. One other feature which deserves mention, made possible by the compactness of the welded construction, is the location of the upper platen, with the outer face flush with the outside of the C-frame, allowing the full width of the sheet to turn up against the press so that the double bend can be accomplished at one operation.

The construction of each of the double C-frames is shown in Fig. 4. Eight ½-inch plates, 14 feet high, and 7 ft. 6 in. wide, cut to shape, and edges beveled, were drilled for forty

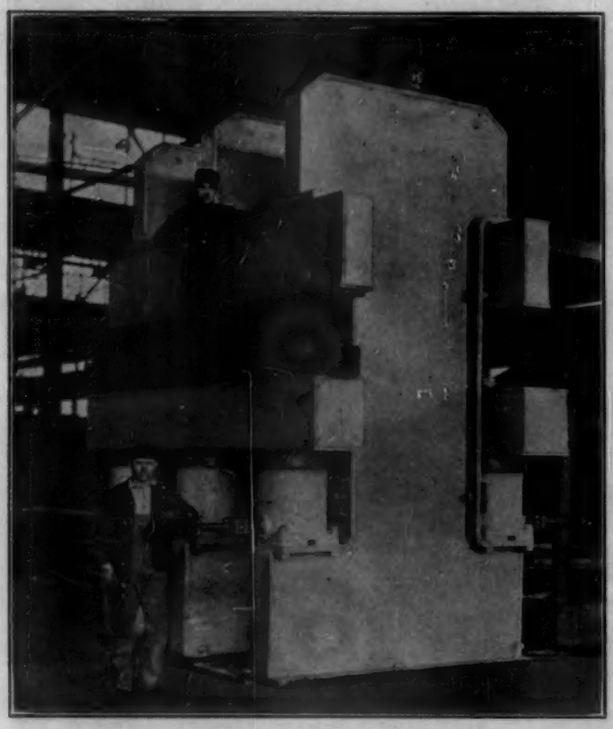

Fig. 1—View of Welded Press Ready for Installation.

⅞-inch bolts, and the holes countersunk. The spacing of the bolts is indicated in Fig. 1 by the location of the welds on the face of the frame. Hexagon nuts were screwed toward the center of each bolt so as to space the inside plates four inches apart. These plates were slipped over the bolts and temporarily held in place by nuts on the outside, while the

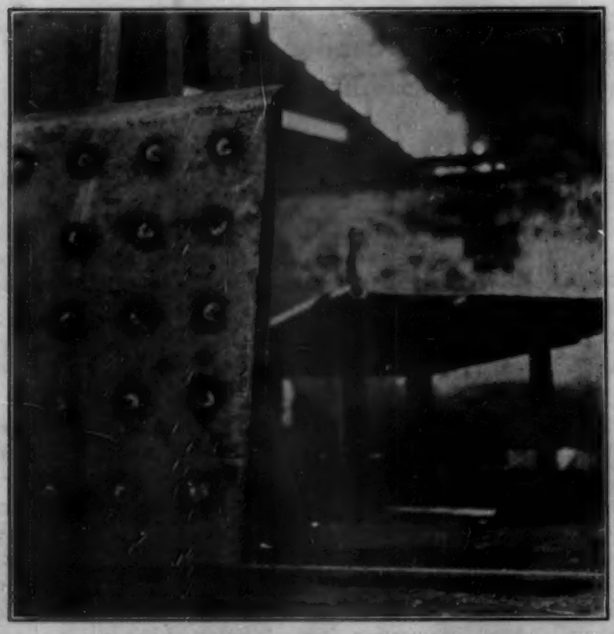

Fig. 2—Side Wall of Firebox, Formed in the Press Shown Above.

plates were welded to the 2-inch plate at the base. The nuts were then removed and the plates welded to the bolts until the countersunk hole was filled and chipped flush with the surface of the plate.

Another instance of novel design to obtain the maximum strength from the least possible material is found in the top and bottom platens, each consisting of I-beams enclosed in boxes of 1½-inch plate. The top platen is built up of a

Fig. 3—Valves and Operating Levers. The Piping System Was Welded Wherever It Was Possible.

24-inch, 100-lb. "I," with ¾-inch stiffeners welded to the web and flanges every 12 inches, and, spaced alternately with these, stiffeners also welded to the side plates of the enclosing box.

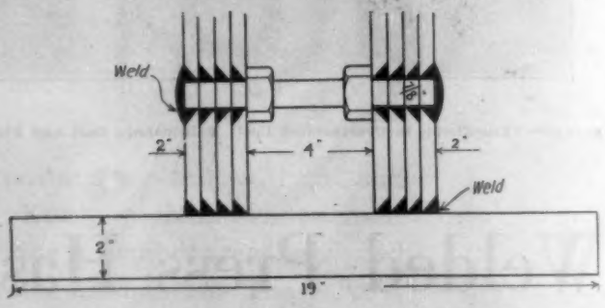

Fig. 4—Details of Construction of C-Frames.

Each of the two bottom platens is similarly constructed of two 18-inch 70-lb. I-beams, with beams and box likewise stiffened. In each case the stiffeners were figured to take the total load at maximum capacity of the press, thus providing

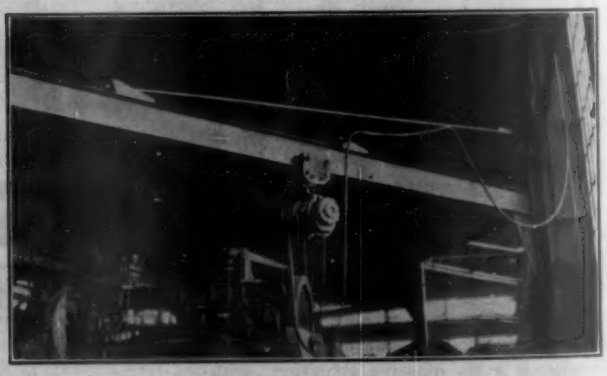

Fig. 5—Many Welded Jib Cranes Are Used in This Shop.

for a large factor of safety.

In designing, problems of failure, bending and tension had to be considered, and this design of both the double C-frames and the platens resulted in a substantial saving in steel and a gain in strength and permanence over the former presses

using massive steel castings which sometimes broke in service. The fact that some of these breaks were repaired by welding heavy steel plate to the castings led to the question as to whether it would not be advisable to build the entire press of welded steel in the first place. The result is the press described, in which castings have been dispensed with entirely with the exception of the six 16-inch hydraulic cylinders.

In the matter of cost, the press was built for approximately one-third the amount that a press of conventional construction would have cost, giving at the same time a press more satisfactory in several respects. The entire labor cost of fabricating amounted to no more than the pattern cost alone for the castings required by the former design.

As an instance of the innumerable uses to which welding is put in this plant, in Fig. 5 is shown an efficient jib crane made of a few standard rolled shapes welded together. One of these cranes is mounted over each of the presses to handle the sheets of work. In this case, as in numerous others about the plant, considerable responsibility is placed upon the welds, with perfect confidence. So far that confidence has never been betrayed by a single weld!

As for the presses themselves, the welds have shown no signs of distress under the tremendous loads placed upon them. With the reduced floor space required, the increased ease of handling the work, repair costs practically eliminated and original cost cut in three, it appears that the plant management has justified its efforts to gain the full advantages welding had to offer by completely revising hydraulic press design to better accommodate it to welding technic.

Fig. 6—Single C-Frame Made in the Same Manner as the Larger Ones.

THIS Pacific Boiler is built for 15 POUNDS pressure.
THIS Hydraulic Press is built for 1700 POUNDS pressure.
Both Are Built of Steel —Electric Welded
This striking comparison gives some idea of the tremendous structural strength which is a feature of Pacific Steel Heating Boilers.
The gigantic press shown above — one of seven used at the Bristol and Waukegan factories in the manufacture of Pacific Boilers — weighs 70 tons and has a working capacity of 1000 tons. It operates at pressures as high as 1700 lbs. per square inch. The basic construction principle of this powerful machine is exactly the same as that embodied in Pacific Heating Boilers, operating at a maximum pressure of only 15 lbs.
Pacific Steel Heating Boilers employ the strongest type of construction yet developed, steel—electric welded.
In both cases, STEEL — electric welded insures rugged strength which is a vital factor for safety and dependability in the operation of boilers. This is just one of the many reasons for the low maintenance costs of Pacific Boilers.
Write for complete information.
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Fig. 7—In This Advertisement the Dependability of Welding Is Made Plain to the Architect and Builder.

TRAVELING CRANE FABRICATED BY ARC WELDING

Designed especially for arc welded fabrication, a 10-ton overhead traveling crane with 60-foot span has recently been constructed by the Cleveland Crane & Enginering Co., Wickliffe, Ohio. This crane is described in a recent issue of Engineering News Record:

Each girder is of fish-belly, box type, consisting of two webs and top and bottom cover plates, both cover plates being arc welded to the webs by a fillet bead. In addition to this weld still greater strength is secured by welding a round bar along the webs and cover plates at each of the four corners of the box section. The area of this round bar is equivalent to that of the angle section which would ordinarily be employed in riveted construction. Girders are reinforced by diaphragms fillet welded to both webs and to the top cover plate. Welding these diaphragms to the top cover plate assisted materially in imparting rigidity to the crane. No attempt was made in the design to take advantage of a possible saving in weight of plates.

The end trucks are of box section completely welded, the side members being standard rolled channels connected by top and bottom cover plates with stiffening diaphragms. In the trolley, the greatest advantages of arc-welded construction is realized. Considerable weight is saved and at the same time greater rigidity and strength is obtained. The side members are standard channels and the bed for the hoist and trolley travel mechanism is a flat plate with reinforcing plates arc welded under the bearing points. Wherever pads and bosses are required to form seats for the hoist and travel mechanism, these are made by welding steel plate of the required dimensions to the structural parts of the trolley. In this manner machining was simplified. It is said that tests made at the plant of the Cleveland Crane & Engineering Co. have amply justified the engineers' estimates of improved design and saving in manufacturing costs.

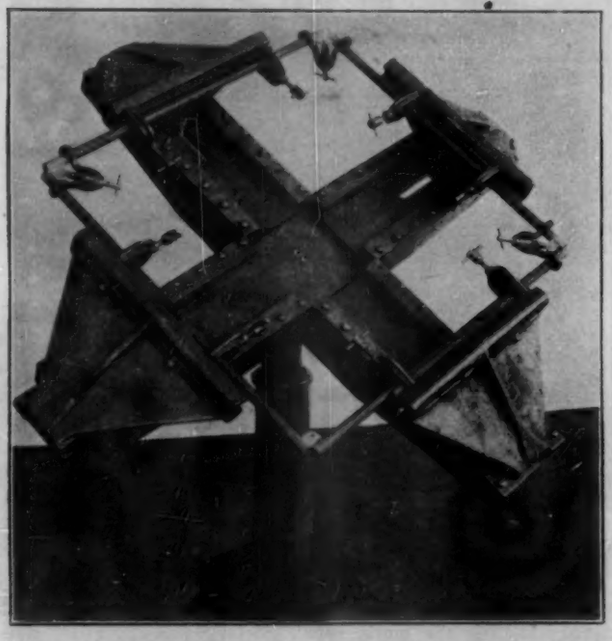
Aircraft Welding Rigidly Inspected

A Study of the Welding Organization in a Large Aircraft Plant Shows That the High Quality of Work Done Is the Result of Good Supervision

By R. K. Doran

WELDING inspection at the Consolidated Aircraft Corporation plant, Buffalo, New York, is a strict rite. After all welding operations are complete and the assembled plane leaves the factory, the entire product has had such a rigid inspection for workmanship that flaws in any part of the structure are most conspicuous by their absence.

All welding on Consolidated planes, like that performed by the majority of companies in the airplane industry, is of the oxy-acetyline type. A corps of 20 highly-trained welders take care of this important department. Being one of the



Bulkhead Corners Joined by Welding on Formed Strips of Sheet Stock.

greatest industrial cities in the country, Buffalo always has at her command a host of skilled workmen in every branch of labor. Therefore it is not a difficult thing to find men who are highly skilled at the art of welding.

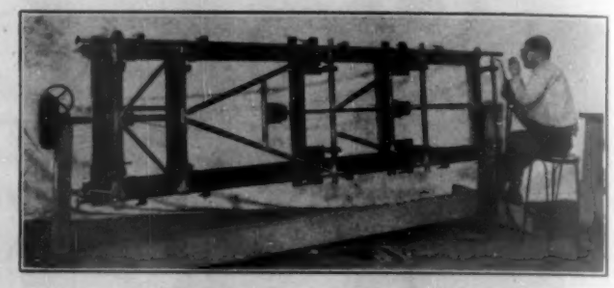
When an opening presents itself for a welder at the Consolidated plant, a rush call is sent out. As the applicants arrive they are put through a rigid, standardized test to determine their general and specific welding qualifications. All such tests are conducted by the boss welder and a high standard of welding skill must be demonstrated before any applicant gains a place on the Consolidated pay roll.

As skilled as many of the applicants are when they apply for welding jobs, a great many of them have not the qualities that go to make up a welder of airplane parts.

Years of experience have taught those in charge of hiring welders and putting them through the rigid tests that qualities which are desirable in all welding operations become positively necessary if a man is to be a valuable asset in airplane welding work.

The welder must not only be capable with the filler rod; he must not only show a steady hand, clear eye, good judgment and ability to turn out well finished work. He must show more than that when he takes the Consolidated tests. He must prove in other ways that he can be trusted to do vital work on an airplane. He MUST have those QUALITIES that lead to implicit HONESTY OF WORK.

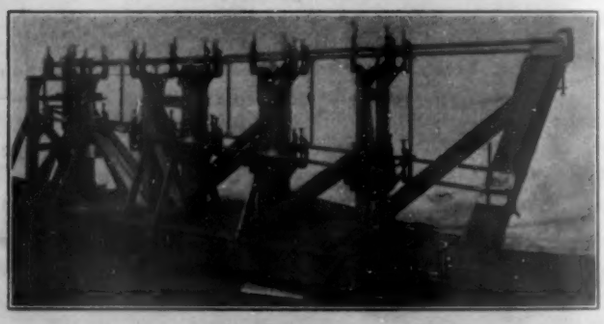
The welding of airplane parts demands this quality of job conscience that is not so essential in other branches of welding. When a plane takes off and wings its way among the



Welding Bottom Portion of Forward Section of Fuselage.

clouds all those welded parts must be perfect; they must hold together because human lives are at stake. Therefore the Consolidated Aircraft Corporation is most exacting in selecting welders who will protect those lives. Right from the very beginning we might say the final tests are made, for in choosing its welders, the firm actually commences to shape its final product.

The welders are kept under minute supervision, their work being constantly inspected by the boss welder and his five assistants. In addition, their work is continually subject to



Complete Assembly of Rear of Fuselage.

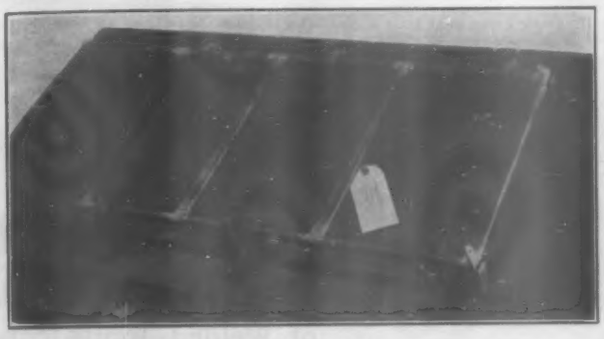
inspection for flaws by other plant inspectors. After the various parts are finally welded and the plane assembled, the entire product undergoes final examination by a corps of government inspectors stationed at the plant. Successfully passing their minute inspection, the plane gets its final test in actual flying. Surviving this test, the plane is ready for shipment.

Static tests are made by government engineers at the very start before any welding whatsoever is done. Then follows the actual welding operations during which time tests by plant inspectors go on continually. Then comes the government inspection tests.

While the boss welder has charge of the entire welding department, he takes specific charge of everything connected

with fuselage welding. The engaging of welders, their strict training and actual work on planes, and the inspecting of all their labor constitute a system that leaves no opportunity for defects to escape notice. The Consolidated Aircraft Corporation, a private concern doing work for the United States government, demands perfection in each and every detail that enters into the construction of an airplane. The welding, being one of the most important operations in building an airplane, naturally calls for supervision of the highest type.

The Consolidated Aircraft Corporation came to Buffalo in September, 1924, and its business for the most part is designing and making of airplanes for the Army and Navy. It has approximately 400 employes who work on steady time year in and year out. The corporation has just finished an order of one hundred and fifty-one planes for the Navy. Already



Set-up for Welding Fin.

the Navy has flown these Consolidated planes more than a million record miles in training students to fly.

The plant itself is located in Buffalo's North-Elmwood industrial district and has every location advantage in its favor for the production of aircraft.

At the present time Buffalo has a large supply of trained aircraft labor, including the all-important welders. This condition is due to the fact that there are five companies actually manufacturing airplanes in Buffalo. And because there is such a number of skilled men to aid in the construction of planes, other airplane manufacturers are being attracted to Buffalo. Another thing that draws these manufacturers to the district is the interest shown by the city of Buffalo in aviation, as evidenced by the construction of the Buffalo airport, said by experts to be the best in the United States.

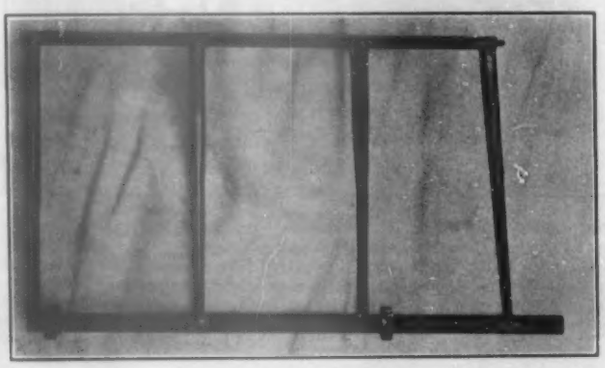
However, "Over fifty per cent of all our welding applicants are rejected," said Mr. David Wilkerson, general foreman. "They all seem to be good general welders but we demand more of a man than mere perfection in welding. He must have qualities that fit in with the high class work that is required in airplane construction."

Welding operations on Consolidated aircraft involve tubing and sheet steel parts. The entire fuselage is constructed of welded tubing as are also the tail surfaces which include the fin, rudder, stabilizer and elevator. Flat sheet metal is used for all wing fittings. Some of these become an integral part of the fuselage after welding. In the construction of the engine mount, both tubing and sheet metal are used. All joints are of vertical or horizontal type.

Parts to be welded are cleaned with a wire brush. In the case of sheet stock where such stock is over an eighth of an inch in thickness, all parts are beveled along the edge to be welded. Sheet stock under this thickness receives the same treatment as tubing. The parts are then put into the jigs to be welded. More than twenty-four different-sized jigs are regularly employed by the Consolidated Corporation.

Tack welding is used when parts are to be brazed. A few drops from the filler rod are all that are necessary to hold the pieces together until brazed. Specification rod is used in the making of welds. This rod varies from $\frac{1}{16}$ to $\frac{1}{8}$ inch in diameter.

An oxygen pressure of around 5 pounds is sufficient. Sometimes when heavy welding is the case this pressure goes to 7 or even 8 pounds. A similar acetylene pressure is used. The tip sizes range from 1 to 4.



Part of Stabilizer.

No overhead welding is done by this airplane company. The general method being the intermittent single layer. In instances where the welding is to be extended over a large piece, as an instance in the 54-inch weld, the welding naturally is of the continuous type. All welded structures are enameled by air brush. Twenty men constitute the department that paints and enamels the finished assemblies. All fittings are cadmium plated prior to enamelling.

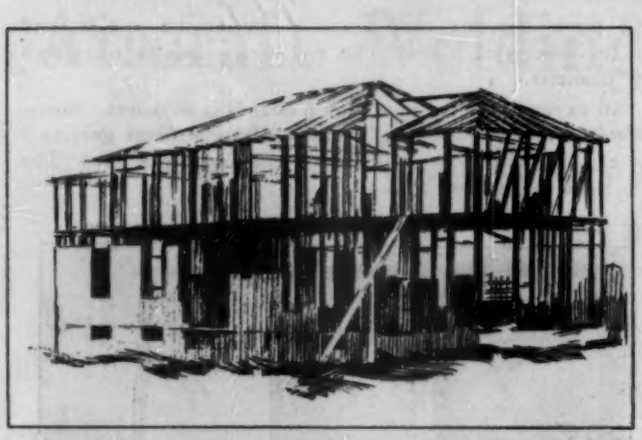
WELDING EQUIPMENT EXHIBITED AT PETROLEUM EXPOSITION

A number of manufacturers of welding equipment and supplies exhibited their products at the Fourth International Petroleum Exposition at Tulsa, Oklahoma. The following firms were represented:

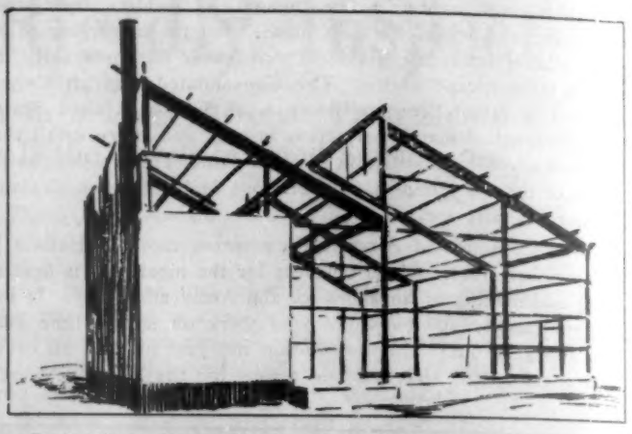
The American Brass Co., Chicago; Linde Air Products Co., New York; Modern Engineering Company, St. Louis; National Carbide Sales Corp., New York; Purox Company, Denver; Stood Products Sales Co., Tulsa; U. S. Light & Heat Corp., Niagara Falls, N. Y., and Welders Supply Co., Tulsa.

HOLSLAG TELLS CHICAGO SECTION ABOUT STRUCTURAL WELDING

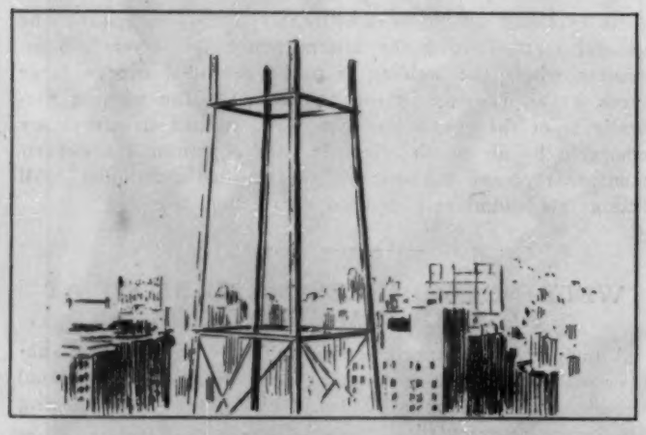
On Friday evening, October 7th, C. J. Holslag, of the Electric Arc Cutting and Welding Company, Newark, New Jersey, addressed the Chicago Section of the American Welding Society on the subject of "Structural Steel Welding." The general theme of his talk was to the effect that there is a great variety of work included in the subject of structural steel welding and it is not necessary to solve the most difficult problems or to prove the value of welding for the most imposing and interesting structures in order to show that welding is applicable to structural steel. Mr. Holslag showed lantern slides of repair work on heavy bridges and of production work on heavy truck trailers which had been done by arc welding and which illustrate the real possibility of using arc welded structures where great strength is required. He placed special emphasis, however, on the great volume of possibilities for welding on small structures where great strength is not required and where welding results in real economy. It is in this field that Mr. Holslag said structural steel welding should have its real beginnings.



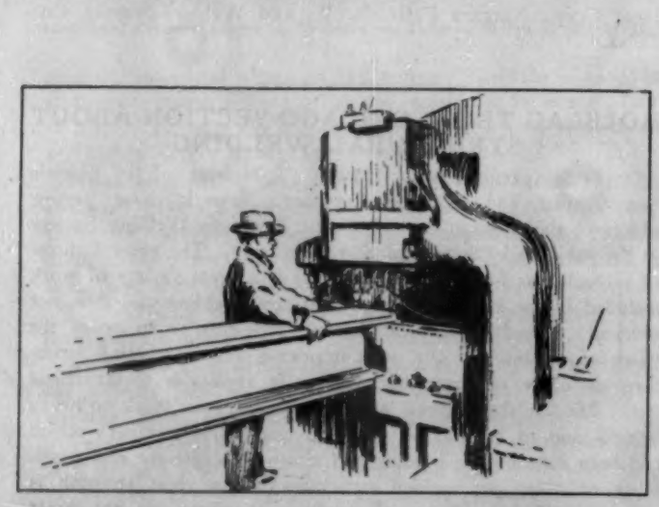
The welded steel frame for residences has passed from the visionary stage at least to the experimental stage, for several such residences have already been built. It is found that this type of construction requires very light steel members, and that they can be so designed as to require only very light welding. Materials are easily handled and the cost of erection is comparatively low.



During the past year it has been impossible to keep up with the record of erection of buildings for factory and warehouse purposes by welding. The very first attempts showed so many advantages that the idea spread quickly. It is becoming quite common for firms using welding in production or repair work to use welding in the construction of new buildings and plant additions.



Simple structures like this demand a quantity of detail drawing for the location of bolt and rivet holes, and if made up to special dimensions each job has to stand all this cost. When welding is used, stock sizes may be cut to dimension in the field like ordinary lumber. As far as strength is concerned, it is interesting to note that riveted and bolted structures of this sort have been repaired by welding.



Here is where savings begin in welded design of structural work. A cutting torch follows a chalk line as a carpenter's saw follows the pencil mark, and the expensive machinery for punching rivet holes is not needed. There are very many special jobs where this saving is an important item. In fact, proper welded design often eliminates parts of connections which are so expensive to produce that the fabricators make little profit on them.

Structural Weldi

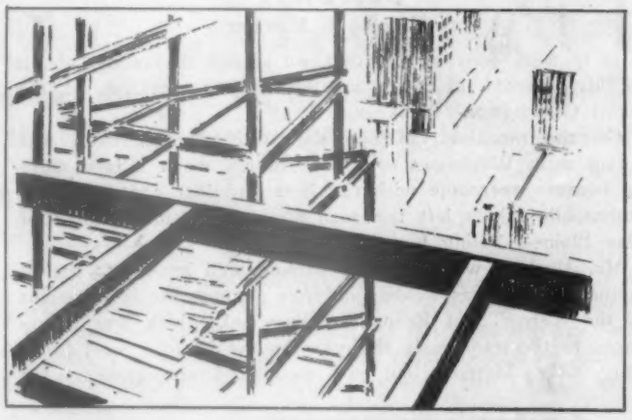
Following Scientific and Practic of Welded Joints, Structural

SO spectacular are some of the problems and questions raised in connection with the application of fusion welding to the field of structural steel, that the subject has been sadly confused for many of those interested in it. The questionable safety of welding the heaviest structures is admitted by the most enthusiastic exponents of welding, but with the reservation that it will only require time and labor to solve the design problems involved. The casual investigator easily overlooks the fact that there still exists a huge volume of structural work which has been welded and still can be welded with perfect safety. Then in the matter of costs comes a comparison of highly perfected shop systems of assembly with experimental work that is necessarily slow and expensive.

Naturally enough these controversies have continued, usually taking the form of two people talking about two different things, and the impression is easily obtained that the welding of structural steel is still questionable and a long way from being started. Interviews with sales and service representatives throughout the welding industry, and reports received from users of the process give an altogether different impression. Work that may quite properly be classed as structural steel welding has been going on for a number of years and is now fast assuming large proportions. There are few large firms engaged in the structural industry who are not using welding to some extent, and a number of them who have become important customers for the welding wire supply houses, which is an ideal index of the condition and tendency of the market.

Because of the necessity for exhaustive study and re-

Bridge building is a class of work which has caused many structural engineers to shake their heads at welded construction. Undoubtedly it is a field that will develop slowly for the process. Meanwhile we have to consider that a bridge will seldom be entrusted with the safety of so many lives as are entrusted to one all-welded battleship, that welding is already used in the repair of riveted bridges, and that steel bridges represent only a small fraction of the total possibilities for structural steel welding.



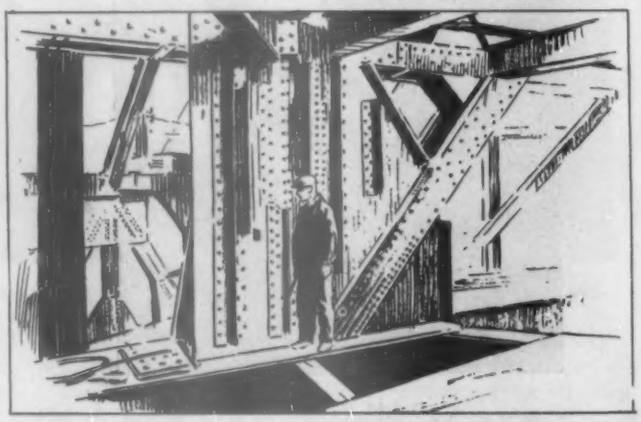
Here is what might be classed as a medium type of structure, the sort of work where welding will soon appear at its best in all probability. A five-story building has already been erected and shows adequate strength with a considerable reduction in the tonnage of steel used. Erection costs were high at first but decreased progressively as the erectors learned through experience how to keep the costs down.

ig Grows Rapidly

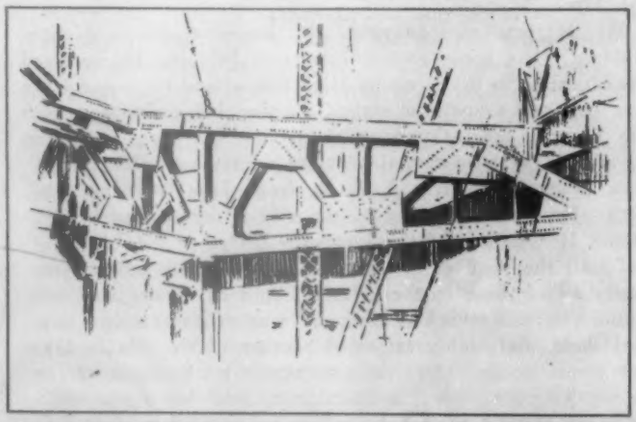
tic monstrations of the Advantages
l E neers Find Many Applications

search for the purpose of obtaining design data that will be useful on future operations, there is frequently heard a call for a complete compilation of all the information a structural engineer needs in applying welding to his work. Such information is available in many other applications of welding, and it would be splendid to have it for structural welding, but in other fields it has always been collected from the field over a period of years, and most probably will have to be collected that way in the present instance. Nobody can do as much for the structural men as they can do for themselves, because structural problems and organization problems have to be mastered as well as welding problems. At the present rate of their progress they should be about ready to get together and exchange ideas and experiences, which would speed up the volume of work done in the structural industry just as the growth of welding in such industries as the railroads was accelerated by group activities which corrected mistakes and multiplied the adoption of new ideas.

The current applications of welding to structural steel include small buildings for both residential and industrial purposes, parts of buildings, such as roofs, doors, crane runways, crane trolleys, parts of bridges, towers, reinforcements to existing structures, heavy machinery bases and frames, gas-holders; staircases and other types of skeleton frames, outdoor advertising signs and miscellaneous heavy machinery parts. Very little of this is of a spectacular nature, but on all of it welding has been successfully tried and is continuing in use. It certainly is not necessary to look hundreds of feet in the air to see the possibilities of great savings to industry by welding structural steel. The impossibilities are unimportant in comparison.



Newspapers have hailed welding as a means of delivering city populations from the terrific noise of the riveting hammers. In the industrial centers, executives feel the desirability of avoiding the racket which decreases the efficiency of workmen in neighboring plants. If the process is used only as an adjunct to riveting on some of this work, it will bring a measure of relief which will be keenly appreciated.



Elaborate connections like this sketch are not at all uncommon on heavy structural work. Designers who become familiar with the use of welded joints on simpler types of construction will be able gradually to extend their application to these jobs, with considerable savings in time and material costs. No matter how much the cost of producing steel may be reduced, it will always be desirable to develop its full strength in design, and welding promises to do this in many instances.

OBITUARY

Harold M. Mattson

It is with deep sorrow that we record the sudden death of Mr. Harold M. Mattson, the former president of the Koro Corporation, Waukegan, Illinois.

On the morning of September 14th, Mr. Mattson was riding from Waukegan to Joliet, Illinois, when it is thought he became overcome with the heat and lost control of his automobile which left the road about three miles north of Des Plaines, killing him instantly.

Mr. Mattson was rapidly becoming well known to manufacturers in the gas welding industry through his development of the Koro Tobin Bronze welding rod, which was introduced to the trade early this year by the Lincoln Steel Company. Mr. Mattson had just completed arrangements for

Harold M. Mattson.

reorganization of the company, changing the name to Koro Corporation and moved plant equipment to new quarters in Waukegan. On the day of his death, the new plant began operations for the first time.

His whole-hearted earnestness in development of a new business and splendid personal qualities had won him a number of friends in the welding industry who will greatly regret this loss.

Mr. Mattson was 34 years old, leaves a wife and three children. His home was in Evanston, Illinois. He received his education in the Kenosha High School and for many years was engaged as pattern maker, starting his connection with the Lincoln Steel Company about five years ago. During the World War he served overseas with the 112th Ammunition Train, 37th Div., A E. F., from June, 1918 to April, 1919. He was a member of the Old Glory Lodge No. 875 of the Masons and of the Evanston Lodge of the Elks.

To all the members of his own organization and to practically all of those in the industry, both customers and competitors, who knew him well, he was affectionately known as Harold, and highly esteemed because of his notable devotion to his family and to the activities of his business.

MANY USES FOUND FOR WELDING IN ALL OIL FIELD WORK

Both arc and oxy-acetylene welding have become very popular in the oil fields, as is evidenced in the constantly widening field of uses found for the processes. One of a series of articles on "Oil Field Engineering," in the Engineering News record, tells of the numerous ways in which field engineers are taking advantage of the savings in time and material which welding makes possible.

Not only in the laying of pipe lines, where welding is increasing in favor, but also in the construction of buildings, sheds, tanks and tank towers, machinery bases, pipe line hoists, stairways and bridges, as well as in reclaiming used pipe, the metallic arc and the torch are continually called upon to do a job that would be more difficult and costly and in many cases less satisfactory by any other method of fabrication. In much of this work, particularly in constructing fences, frames for buildings, crane runways and field apparatus, scrap pipe is used which could not be used to advantage in any other way.

Boiler repairs are almost exclusively made by welding. The same is true of repairs on storage tanks, in some cases the cost of a new tank being saved by a few hours work of a welding crew. Pipe fittings for heavy duty are often made up of welded pipe sections. The complicated pipe layouts at intake and discharge manifolds of pipe line pumping stations in many cases have been simplified by welding.

Welding plays a particularly important part in the manufacture and erection of refining and cracking apparatus. When a piece of equipment is built to work under 350 lbs. pressure, and contains highly inflammable materials, it must be built right. There must be no leaks, no poor work anywhere, or it is likely to mean loss of lives and destruction of the plant. In the case of one set of stills in particular, described in the National Petroleum News, every seam and joint was welded, the work being done by men trained on the job by skilled welders, and under close supervision. When the four units were fired up, there was not a leak and not a flow in any one of them. This is the more remarkable when it is considered that each of the units contains between 800 and 900 welds. They have been operating without a hitch ever since they were started up.

The writer points out that by holding rigidly to what has been proved the best welding procedure, and by always carefully selecting both structural and weld materials, a great deal has been accomplished in overcoming any hesitancy on the part of designing engineers in employing welding in the manufacture of high-pressure apparatus for any purpose.

STEEL DRUM WITH WELDED SEAMS WITHSTANDS HEAVY PRESSURE

A steel drum having all seams arc-welded was subjected to a pressure of 3,000 lb. per sq. in. without failure at a recent demonstration at the Sharon, Pa., plant of the Petroleum Iron Works Co. and its associate, the Penstock Construction Co.

The test, which is described in *Engineering News Record*, was one of several made in the presence of about thirty engineers representing various industries who were interested in the results of the research and progress made with electro-metallic arc welding.

Several containers, completely welded by this method, were subjected to destructive pressures. In every case where a fracture occurred, it was in the plate at some distance away from the weld. One of the containers, 3 ft. in diameter and 2 ft. 6 in. in length, with dished heads and a one-piece shell, all of ¾-in. plate, was subjected to successive hydraulic pressures of 1,500, 2,500 and 3,000 lb. per sq. in. without showing a trace of moisture at any of the joints. At 3,090 lb. per sq. in. the hydraulic connection blew out and the test to destruction was not made. However, the container had lengthened 5¾ in. and increased almost 14 in. around the circumference midway between the heads. The computed bursting pressure was 2,100 lb. per sq. in. and the tensile strength for the steel was figured at 50,000 lb. per sq. in. The internal pressure of 3,090 lb. per sq. in. reached in the test corresponds to a tensile strength of 73,500 lb. per sq. in. in the shell.

Correct Arc Length

A Study of Metal Transfer Furnishes the Basis for Determining the Proper Length and a Practical Means for Maintaining It

By J. B. Green*

FOR a number of years, the advantages of the short arc in metallic arc welding have been generally recognized. Little has been said about it, however, other than that the short arc is the best. "Short" is a relative term and is almost meaningless without a standard for comparison. The slow motion movies taken with invisible, infra-red light, by the Research Department of the Chicago Steel and Wire Company have permitted studying critically the mechanism of the metallic arc transfer. Such a study seems to furnish the basis for correctly stating just how short the arc should be for the best results.

There are only three states in which matter may exist, that is as a solid, as a gas and as a liquid, so that it is necessary that the metal must transfer from the electrode to the weld in one or more of these states. No one has ever imagined that it passed in the solid state and probably none of it does, except possibly a very small percentage under rare conditions seldom, if ever, met in practice. Simple observation permits determining that at least some of the metal transfers in the liquid state. Some vapor is required as an electrical conductor to maintain the arc so at least part of the metal must vaporize. Whether or not much or any recondenses to form the deposit cannot be determined by ordinary observation. Escholtz attempted to solve this riddle by mathematics. He evaluated the heat input in watts, which is the product of the amperes and arc voltage drop, then showed that this total heat available is only a fraction of that required to vaporize the metal transferred to the weld. He used the specific heats of iron and latent heats of fusion and of vaporization in his calculations. The apparent conclusion from these mathematical deductions was that very little if any weld metal transferred by vaporization and condensation. The slow motion movies seem to indicate quite clearly that this conclusion is correct. The metal is seen plainly to pass in molten drops. Between drops, the weld deposit does not seem to enlarge at all, while, when the drop passes, it enlarges apparently in exact proportion to the volume of the drop.

When a sufficiently long arc is held, the molten drop is detached by gravity as soon as it reaches a certain size. It thus falls across, and, during the transfer, is out of contact with both the electrode and the weld deposit. If the arc is progressively shortened, a length will be reached at which the molten drop touches the weld deposit before it becomes large enough to fall by gravity. Under such conditions the molten metal is literally pulled across by capillary attraction. During this capillary transfer, the arc goes out and as the molten metal spreads out in the deposit, the arc is automatically reestablished, providing the ratio of rate of arc vapor dissipation to rate of transfer is such that the vapor has a low enough electrical resistance. If this vapor dissipates more rapidly, thus becoming diluted by the relatively high resistance of the surrounding atmosphere, the arc stays out. As the arc is made still shorter, the metal, of course, continues to capillary across but in smaller and smaller drops. The interval during which the arc exists becomes less and less, while the time the arc is out, due to the metal capillarying, becomes greater and greater. An arc length is finally reached which is so short that the electrode freezes. As this short length is approached, the penetration becomes less and the welder will speak of such conditions as a "quenched arc."

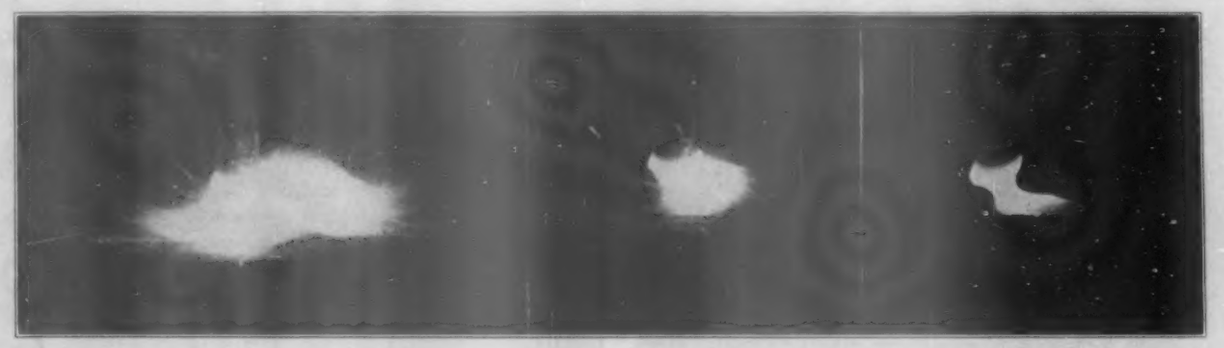


Fig. 1—Three Successive Stages of a Single Drop of Metal Passing by Capillary Attraction from the Electrode to the Deposit.

The above remarks will be better understood by referring to Fig. 1. This shows a drop passing from the electrode to the weld by capillarity. At the left, the drop has reached its maximum size for the arc length used and is just about to touch the weld metal. In the center, the drop has just touched the weld metal. Note that the neck of the drop next to the electrode remains as a sort of collar. This indicates that, while the metal at the neck is hot enough to be pasty and spread out to match the contour of the drop, still it is not actually liquid. More will be said of this later. The picture at the right shows the drop just about to neck off. The arc is actually out but just about to be reestablished. The collar of white hot but not liquid metal can still be plainly seen at this stage. These pictures are very close to actual size, a 3/16-inch electrode being used. Photographing the successive stages of the transfer of a single drop, using infra red light so that the haze surrounding the arc is penetrated, permits studying the actual mechanism of the metal action in the arc. Probably for the first time, the presence of the non-liquid collar at the neck of each drop in metal passing by capillary attraction has been identified. Other experiments indicate that the damage often suffered by arc passed metal in welding occurs at least mostly at the neck of the drop. By flux coating the electrode with some material such as "Thorium Oxide," which has the property of adequately wetting the hot metal especially at the neck of the drop, the arc becomes practically silent and very little chemical reaction takes place. Ordinary observation tells us that the arc flame itself pretty well surrounds and protects the bottom half or more of the molten drop. This fact is also indicated in the left hand picture of Fig. 1. The liquid metal in the arc is always violently agitated. If the surface is exposed to the air, thus allowing the metal to combine chemically with the oxygen and

*President, Fusion Welding Corporation.

nitrogen, which it really does, and these oxides and nitrides are instantly stirred into the molten mass thus exposing fresh metal, the oxide and nitride content of the weld metal is bound to be high. It is the presence of these compounds that causes brittle metal in the weld. On the other hand, if the only hot metal which comes in contact with the air remains solid, the oxides and nitrides form on the surface only, and are never stirred into the metal mass. The first thin layer formed, itself, protects the metal beneath from air contact.

It follows from the above discussion that there is a critical arc length above and below which the character of the metal transfer changes. This length is the longest at which the major portion of the electrode metal capillaries across. Above this, the arc is never out, while at it and below this critical length the arc is out part of the time. While, of course, there are many factors entering into good welding practice, looking at the matter only from the standpoint of arc length, the ideal length is the longest possible and still transfer the major portion of the metal by capillary attraction. Longer arcs slow up the melting rate, decrease penetration and damage the weld metal. Shorter arcs slow the melting rate, decrease the penetration but do not damage the weld metal.

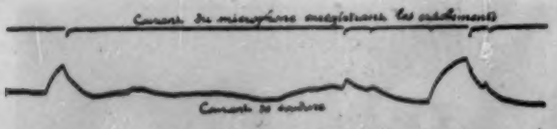


Fig. 2—Oscillograph Curves Showing (top) Simultaneous Values of Sound and (bottom) Current for the Metallic Welding (Brillié).

This critical arc length is generally recognized as a short arc, but too short an arc is almost, if not quite, as bad as too long a one except possibly in special cases. This generally correct or critical arc length will vary with the electrode and so it is impossible to express it in inches. Most welders can feel their way to this correct length because it is usually the easiest to hold. Some, however, who have been taught to worship the short arc gradually become so skillful that they can readily hold an arc much shorter than this correct length. Like most good things too much of them are bad and so it is with the arc shorter than this correct length.

The easiest arc is not always a safe way to determine the correct length. This may throw the operator off the right track if the volt-ampere characteristic of the generator is not such as to best meet the welding conditions in a particular case. Little attention has been paid in welding to anything except the current. As a matter of fact, the arc heat is represented by watts which are the product of amperes and arc volts. If the welding generator maintains a constant current, the watts vary directly with the arc length; if a constant arc voltage, the watts vary indirectly with the arc length. The volt-ampere characteristic of commercial generators is never a true constant current or, arc voltage, and so the "watt-arc length" characteristic will be a curve starting and ending with zero and reaching a maximum watt value somewhere between. Not many of the welding generators on the market are provided with complete manual control of the volt-ampere characteristic so that the maximum watts, or in other words, heat can be regulated to occur as close as possible, consistent with other conditions, to the point representing the correct arc length for any given type and size of electrode. This matter of volt-ampere characteristic is really another subject and is only mentioned here because it is related to a practical means of determining the correct arc length.

The easiest arc length not being an entirely dependable guide, it must be used in conjunction with an examination of the weld deposit and the arc itself in operation. When the proper arc length has been determined as accurately as possible by such means of observation as are available to the welder, its sound should be memorized. The skillful welder will find this to be a very good guide and, so guided, will unconsciously hold a certain arc length.

Some knowledge of the cause of the sound of the arc will give this matter a greater significance to the welder and help him to better control his work. An article on the theory of arc sputtering, by the present author, has already been published in the January, 1927, issue of the Welding Engineer, so what was there said will not be repeated here. The sound from the arc seems to be due to sputtering and to the reestablishment of the arc. The first tends to cause non-rhythmic vibrations of the air while the latter tends to cause rhythmic. If the drops pass rapidly enough by capillarity, the tendency is to produce a fundamental note, the pitch of which depends on the rapidity with which the drops pass.

Jean Brillié, chief engineer of La Sodure Autogéne Francaise of Paris, France, has made some investigations along related lines. One of his sets of oscillographic curves is reproduced in Fig. 2. Two oscillographs were arranged to record on the same tape. One was connected to record the instant changes in the welding current while another connected to a microphone placed near the arc recorded simultaneously the instant changes in the sound emitted by the arc. In Fig. 2, the upper line represents the sound, and the points at which this line shows vertical drops indicates sharp increases in the volume of sound. The lower line represents amperes, and where this line rises an increase in current is indicated. Enough of the oscillograph curves are shown in Fig. 2 to cover the passage of two drops of metal. As the drop passes, the arc is short circuited and the current usually rises sharply. By comparing these sound and current curves, it will be seen that the sharp sound invariably occurs as the current changes from a rising to a falling one. Putting it another way, these sounds occur at the point where the rapidly increasing surge of current due to short circuiting the arc, is arrested through the arc being reestablished. Quite probably the sound is produced in a manner very similar to the phenomenon of thunder following a flash of lightning. It is also quite possibly analogous to the "water hammer" resulting from quickly arresting the flow of water in a pipe by turning off the faucet. The sudden arresting of the flow of many forms of energy seems to tend to produce sound. Knowledge of these things, while not of vital importance to the welder, still always add interest to the art of welding.

Summing up what has been discussed, it seems that the ideal arc length is a short one, to be sure, but more properly described as the longest that still transfers most of the electrode metal by capillary attraction. The most practical way for the welder to maintain such an arc length is to determine by observation, through running an electrode on any particular job, an arc of this correct length, then memorize the sound, and be guided by this on all repetitions of the same job under the same conditions.

"THE WELDING EYE"

The following editorial from the September 22nd issue of the American Machinist deserves a reading by every plant superintendent and designing engineer:

"Many a designer has failed because of his inability to visualize a piece in the light of new methods. A case in point is the difficulty of visualizing a structural member as anything but a riveted unit. If the designer is unable to break away from the traditions of riveting practice he cannot hope to attain the success that would reward him otherwise, because a member of a riveted assembly that has been modified to be welded is never as economical or satisfactory as one that was laid out primarily to be welded.

"Anyone can call to mind many similar instances in other fields of design, but the example chosen is significant because of the growing importance of welding as a metal working process. It is so new that experience is often unable to solve small problems. The exercise of gray matter that must take the place of experience in such a case never hurt anybody yet. It must occur behind eyes that are not blinded by rivets."

Welded Piping for Every Purpose

Elimination of Mechanical Joints Results in Economy of Installation, Increased Efficiency and Longer Life for Pipe Installations

WHEN one considers the tens of thousands of miles of pipe that are installed every year—oil and gas trunk pipe lines, lines for compressed air and gases, steam and water lines for power and heating in industrial and domestic systems—and learns what has been accomplished in reducing the cost, increasing the efficiency, and lengthening life of pipe systems by abandoning the time worn methods, it is surprising that plant managers, plant designers, engineers, plumbing and heating contractors everywhere have not in the past availed themselves more readily of these savings made so

Fig. 1—Bends of Any Radius or Curvature Can Be Produced to Meet Any Requirements. The Smaller Bends Can Be Made on the Job.

easily possible. But the leaders have done their pioneering, have proved the case for welding, and there is no longer any excuse for hesitancy on the part of those concerned in the designing or fabricating of pipe systems for whatever purpose.

In the plumbing and heating field one of the most progessive contractors in the Middle West has employed welding on an increasingly large scale for the last ten years with results, in the matter of cost and service, that will give food for study to anyone contemplating a pipe installation. What is more, this contractor has not been able to discover a single valid reason why welding should not almost entirely supersede all types of mechanical fittings. There are cases, no doubt, where a fitting will have an advantage over welded joint, and there a fitting should be used. But such cases are so comparatively few as to require no consideration in this statement of the proven advantages welding does possess.

One of the first questions usually raised is the matter of cost. The installation cost, if the work is done by competent pipe welders, now easily obtainable, is certain to be less than if fittings were used. What is often more important is the maintenance cost. A welded joint will last as long as the pipe itself. A mechanically fitted line shows its age first at the fittings. In threading a pipe, metal is necessarily removed, reducing the effective thickness of the wall by one half. In welding, metal is added instead of subtracted, increasing both strength and life of the line.

An example of one reason why this contractor interested himself in welding was recently shown the writer. In tak-

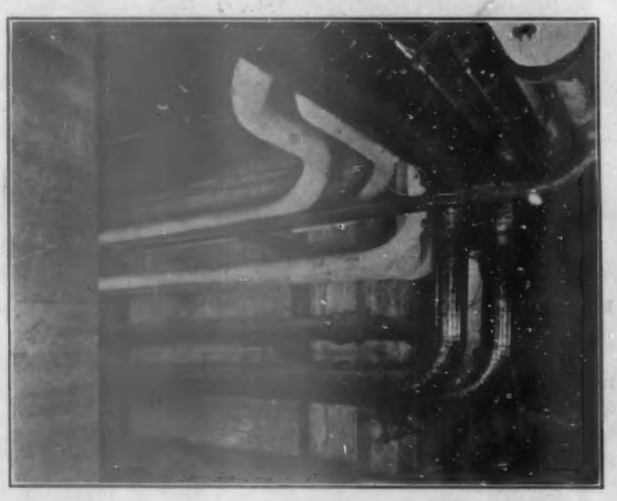


Fig. 2—Wide, Easy Bends Reduce Friction and Increase Efficiency of Pipe System.

ing up a line which was giving trouble on account of leakage, it was found that the pipe itself was still good for many years of service, but that in several places corrosion had eaten entirely through the thin wall at the threads. The natural question is: Do we have to thus weaken two pieces of pipe in order to join them together? The completely welded line has proved to be the answer.

Another item which figures in the cost is the fitting wasted every time a joint is added. There is no over-lapping of pipe and few, if any, heavy flanges in a welded line. In such cases as condenser coils in a refrigerating system, for example, this elimination of cast fittings has reduced the total weight by nearly one-half, thus cutting the production cost and practically doing away with maintenance costs.

A welded pipe system is not only less expensive to install and maintain but is also more efficient, offering less resistance to the flow of liquids or gases. The interior diameter being uniform throughout, and the substitution of pipe bends for fittings doing away with sharp turns in the line, the resistance is reduced to the least possible minimum. Fig. 2 shows a number of these wide, easy bends, which are easily produced, and for a fraction of the cost of standard fittings.

A test has been conducted to illustrate the effect of wide bends. A line of pipe with six bends, requiring twelve standard ells, was connected with a barrel filled with water, and the water was allowed to flow out. Sixteen minutes were

required to empty the barrel. For the twelve ells were then substituted six pipe bends such as would be used in a welded line, and the barrel was emptied in eight and one-half minutes. When mechanical power is used instead of gravity to propel a liquid through pipe, another source of saving becomes manifest.

Still another saving worth considering in the case of a steam line is the economy of steams due to the fact that expansion troubles are lessened in a properly installed welded system, making it possible to turn steam on and off at more frequent intervals than is considered advisable with a line fitted with flanged and screwed couplings. This does not

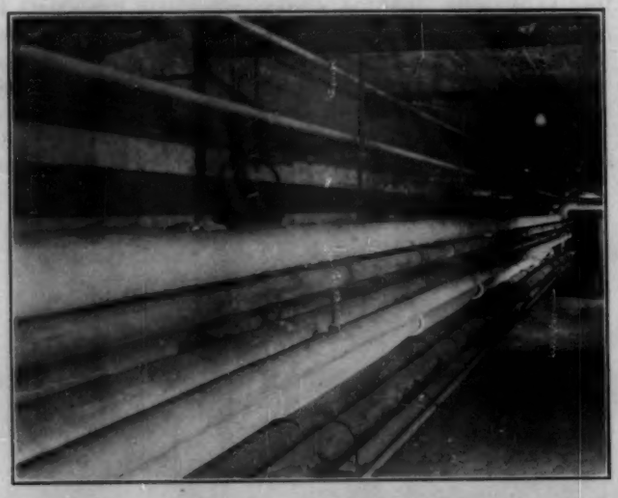


Fig. 3—Absence of Fittings and Flanges Makes Possible Such Compactness in a Large Installation.

mean of course, that a welded line will withstand sudden heating and cooling indefinitely. Such abuse must be avoided by the operating engineer as in the case of any other steam line.

A welded line requires less space, a decided advantage in many places where a limited amount of space is available. Fig. 3 shows a typically compact installation. There were other stretches in this same system in which there was barely room for the required number of pipes to pass through; fittings at each joint would have made it necessary to reduce the size of the lines, or to remove part of the building structure, or to follow a less direct route.

On account of the sinuous, articulated layout of most lines, expansion and contraction are automatically taken care of without danger of cracking when heavy cast fittings have been eliminated, with their stiffening effect producing abrupt strains or throwing the pipe out of line. Further elasticity is provided by the fact that hangers can come at the joints when welded joints are used. In the case of a long line without bends, expansion and contraction can be compensated by a simple bend such as is shown in Fig. 4.

One common difficulty with the line assembled with fittings is the awkward, time-consuming procedure often necessary in making repairs, adding a new line, or dismantling an old one. With a welded line the procedure is very simple and efficient. Repairs can usually be made with the pipe in place; a new line can be added simply by cutting a hole in the old line and welding in the new section; an old line can be removed by cutting at convenient points with the torch, which is very quickly done, and leaves the pipe in condition for reuse after beveling the ends by machine or torch.

Besides being cheaper, more durable and more efficient, a good welded joint should be stronger, more capable of withstanding tension caused by weight of the line itself or by pressure of the contents. Where high pressures are to be carried or other strains imposed on the line, it is often best to anneal or normalize the joints after welding to release any stresses that may exist in the joints and to provide a more uniform structure in the metal. Swaged joints are altogether unnnecessary. The chief excuse for this and other means of reinforcing the joint, aside from addition of weld metal, are mostly psychological.

The question sometimes arises as to whether the weld rusts more easily than the original pipe and requires any special covering. The welded joint requires no more protection than the rest of the line. On the other hand, when it is necessary to cover the line by painting or by insulating, the smooth surface of unform diameter made possible by the

Fig. 4—Expansion and Contraction Are Taken Care of by Bends Welded in at Proper Intervals.

welded joint greatly expediates the work of covering. And insulation, once put on, almost never has to be removed on account of leaks developing at the joints.

This absolute dependability of a welded pipe joint is perhaps one of the chief reasons why its universal use is certain for the future. Modern building construction completely conceals the piping and often makes it very difficult to locate leaks, and equally difficult to make repairs when the trouble is located. This difficulty can be obviated once and for all, at least for the life of the pipe, by fabricating the whole system by welding.

The matter of training operators should no longer be a problem. Competent instruction in pipe welding is available today to all who want it. Welding equipment and operators are obtainable in almost any plant, and commercial welders for small jobs can be secured practically on a competitive basis. The contractor referred to finds that in the building trades it is more satisfactory to train steamfitters to use welding than to employ welders who have been doing other classes of pipe work. Another contractor declares that a new man is not allowed to use the torch on a job except

for heating or, after a little experience, some cutting, until his welding training has been as thorough as his steamfitting training.

Proper supervision and inspection by one thoroughly familiar with the theory and practice of welding should always be provided. The completed job should be tested to considerably more than the pressure to be carried.

In hiring or training operators, the following requirements of a first-class pipe welder should be kept in mind:

He should have a thorough knowledge of the composition of steel pipe, and should be able to select the proper welding wire to be used, and to select the proper size welding tip for any given size pipe. He should experience the testing of welded specimens made with oxidizing, carbonizing, and neutral flame. (High pressure air, tensile and bending tests should be made on such specimens to determine the extent to which a weld can be carbonized or oxidized without decreasing the quality beyond a safe point). The welder should be able to make a 100 per cent weld on pipe in a vertical or horizontal position. He should be able to lay out patterns to be used in cutting out tees, elbows, or return bends.

A welder should be well versed as to the construction of at least three leading makes of welding equipment. He should be able to keep his helpers busy at all times. He should

Fig. 5—Weight, Cost and Maintenance Expense of These Brine Coils Were Reduced by Substituting Welded Bends for Fittings.

have a thorough knowledge of how to take care of welding strains, and should know the methods by which strains can be prevented to some extent. He should be able to read blueprints of pipe installations, and should be able to estimate the quantity of acetylene and oxygen required for a particular job. Finally, he should be ingenious, and honest and dependable as a workman.

It is true that few designers yet have learned to think in terms of welding. Screwed fittings, flanges, bolts and rivets still are specified unnecessarily in the design of machines, steel structures, pressure vessels and piping systems, in spite of the advantages of welding that have been proved in service. Others who do employ welding make the mistake of trying to adapt this new means of fabricating to old designs. This applies as well to the planning of a pipe line. The designer must think in terms of what the operator can construct in the field; also taking into account the fact that special fittings (bends, tees, reducers, etc.) can always be made on the job. Plant engineers, structral engineers, and contractors who have come to take welding for granted have discovered that many opportunities for simplification and for improvement in other respects continually manifest themselves.

The most conspicuous example of what can actually be accomplished in this field is the welding of trunk lines in the oil and gas fields. Pipe lines hundreds of miles long, laid under a wide variety of climatic and geographic conditions, carrying pressures of several hundred pounds, continuously welded throughout their length, have put the principle of pipe joinery by welding to the most rigorous test imaginable. The result has been a tremendous reduction in maintenance costs, a considerable saving of gas and oil (millions of gallons of which were formerly lost through leakage from screwed pipe and riveted tanks), and a general improvement in the efficiency of the lines.

Piping for all industrial and domestic purposes holds exactly the same possibilities. So far, it has been a few progressive contractors, and a number of plant engineers who are accustomed to using welding wherever possible in all plant operations, who have come to regard a welded pipe joint as the only type of joint worth considering in laying out a new line or tapping an old one, and who are demonstrating, by results obtained, to the whole plumbing and heating trade and the engineering profession that mechanical fittings are no longer the cheapest or best means of joining pipe.

CONFERENCE ON ENGINEERING MATERIALS AT BERLIN

The 1927 Conference on Engineering Materials will take place from October 22nd till November 13th at Berlin. The program of papers contains about 200 lectures to be read by scientists and practical engineers. Foreign scientists will be the speakers, especially in some series of lectures to be held on October 31st. The sessions on November 1st will be devoted to welding. While these papers, which are read at the Technical University of Charlottenburg, are intended chiefly for engineers, an exhibition of engineering materials arranged in the Neue Ausstellungshalle on the Kaiserdamm will be an attraction for the general public also. Everybody will have the opportunity to take a glance into the laboratories and testing shops of modern industrial works. There will be seen the most up-to-date methods of material testing and demonstrations of the properties of the different engineering materials, the way of employing and of working them.

Three groups of engineering materials will be dealt with namely: Iron and Steel, Non-ferrous Metals and Electrical Insulation Materials.

More than 200 testing machines, which will be shown in operation will introduce the visitors into the latest methods of testing, which are not familiar even to many enginers. Many inquiries on the part of foreign diplomats accredited in Berlin prove that the continental and oversea engineering world is highly interested in this new and unique congress.

Detailed particulars are given by the Geschäftsstelle der Werkstofftagung," Berlin NW7, Ingenieurhaus.

STILL ANOTHER USE FOR ACETYLENE

Foundries here and there are finding that a quicker and more satisfactory method of graphiting molds for castings is to use a welding torch with a low-pressure carbonizing flame, by which the inside of the mold is very quickly and thoroughly smudged, leaving the surface absolutely dry and well lubricated to produce a smooth casting.

A VARIETY OF USES FOR WELDING IN THE SULLIVAN MACHINERY COMPANY PLANT

An excellent example of the versatility of welding is found in the plant of the Sullivan Machinery Company at Michigan City, Indiana. While welding is not used on a large scale at any point in the production program, innumerable uses are found for both the arc and the torch, and a welding department is kept always busy.

A considerable amount of welding is done to reclaim faulty

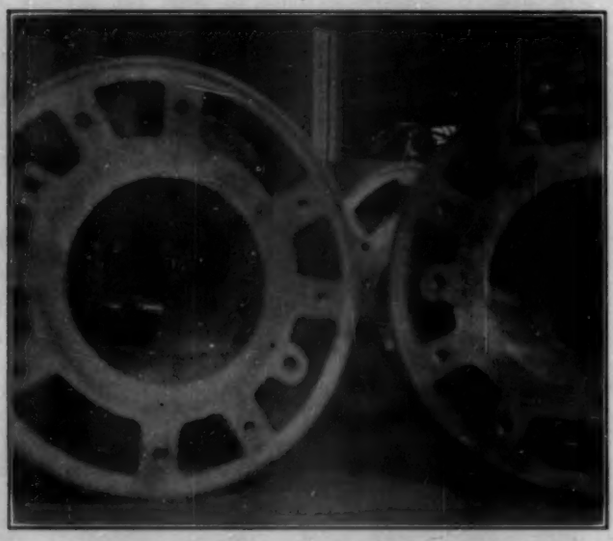


Fig. 1—Cylinder Head Castings, Many of Which Are Saved by Welding Flaws as They Come From the Molds.

castings, not only to fill blow holes or other flaws, but to correct measurements. One example is illustrated in Fig. 1. This shovel, a large and intricate steel casting, was found to be an inch too wide at one end. Accordingly, the inch was removed at the point indicated by the light spot in the foreground, the casting was heated on each side with the torch and bent in to the desired width, and welded together again.

In the case of a roller arm which was 2 inches too short, the

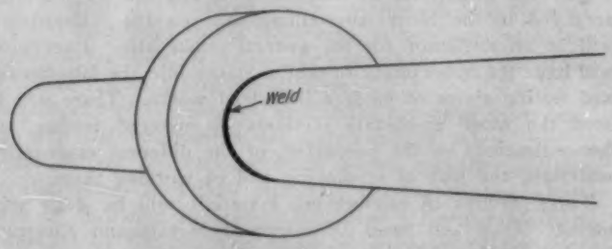


Fig. 3—Collar Welded to Drive Shaft.

arm was cut in two with the torch and a 2-inch piece of cold rolled steel welded in. In each of these cases, an expensive casting was saved at a very small cost. The reclamation of faulty castings, such as the cylinder heads shown in Fig. 2, by welding up holes, cracks, or other defects, likewise saves this plant thousands of dollars annually.

Piston heads, made of cast iron, are reinforced by drilling and tapping for four steel rods, which are ground flush with the casting and "spotted," or locked in position, by a small electric weld at each end. This has proved a very rapid and effective way of locking bolts and pins in position.

Many tools and small parts are built by electric welding, such as links, adjusting screws, and stone bolts, the last being made by simply cutting the desired length from a standard cold rolled rod and welding a nut on one end. Besides costing less, this method makes it unnecessary to carry a stock of numerous lengths of foundation bolts.

Fig. 3 shows a 10-inch drive shaft on which a collar is gas welded as shown, and the weld then machined flush with collar and shaft. This is a regular production job, and in spite of the heavy duty of this shaft no weld has ever failed in service.

A considerable amount of Stelliting is done on bits, bearings, and other parts subjected to unusual wear. This process has proved of great value in the production of heavy-duty mining machinery at the Sullivan plant.

Spring guards, gear guards, and other sheet metal parts are all entirely welded. Some irregular shapes, which have always been difficult to weld without distortion, are being handled very successfully at this plant, the gas welders having developed a technic which practically does away with warping. Most of the welds come at the corners, and it has been found that by directing the flame at a tangent to the corner, enough heat was obtained for a good weld without driving the excess heat into the sheet.

In the case of the spring guard, which is simply a sheet bent

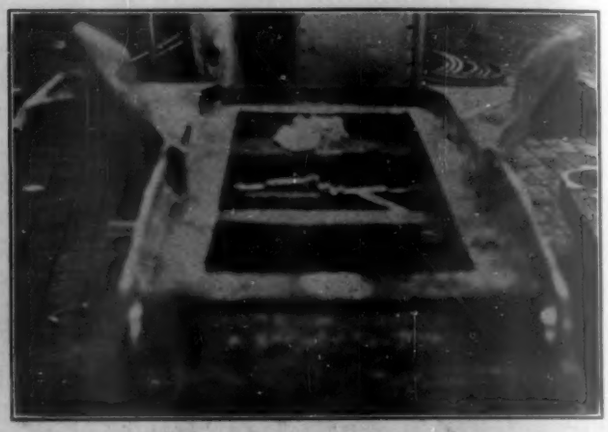


Fig. 2—Shovel Casting Which Was Cut to Size with the Torch and Welded Together.

into a cylindrical shape, with one longitudinal seam, warping is avoided by wrapping the sheet around a heavy tube or rod of the required diameter, which distributes the heat sufficiently to prevent distortion.

These are only two out of numerous examples of the ingenuity of the welders in this plant—examples of what operators can do to improve production in small as well as in large ways.

ALWAYS A USE FOR WELDING IN THE POWER PLANT

A regulating valve on a water line having worn out, a new valve of a different make was purchased which was shorter than the old one, so that the tee on the line would not fit. A new tee was made by flanging both ends of a 4½-inch pipe in which a hole was cut for a 3-inch pipe of the required length, which was welded in place and flanged at the other end for the valve connection. This made-to-measure tee saved considerable time and material.

In another part of this same plant two steam lines to be connected were 8 inches off center. The pipes could not be turned so that elbows would face each other, nor could two 45-degree elbows be used. Instead of attempting to bend the heavy pipe, a section was cut according to exact measurements, the ends mitred to the proper angle, and welded to the two main lines to be connected.

OVER SIXTY THOUSAND ATTEND DETROIT SHOW

Registrations at the Ninth Annual Steel and Machine Tool Exposition, with which was included the Third Annual Exposition of the American Welding Society, held in Detroit, throughout the week of September 19th, were in excess of 60,000. All of the available space in the big Exhibition Hall on Woodward avenue was filled with the exhibits, which covered a wide variety of enterprises in the metal working industries. Never before has one exposition given visitors an opportunity to get a better understanding of the different welding processes and their applications.

The oxy-acetylene process was represented by the exhibits of: The American Brass Company, Air Reduction Sales Company, Carbic Manufacturing Company, Imperial Brass Manufacturing Company, Keith Dunham Company, Krembs & Company, Linde Air Products Company, Alexander Milburn Company, Shawinigan Products Corporation, Torchweld Equipment Company, Wall Brothers Company, Weldit Acetylene Company. The oxy-acetylene apparatus made by the Bastian-Blessing Company and the Modern Engineering Company was exhibited in the booth of local distributors.

The electric arc welding end of the industry was represented by: The Electric Arc Cutting and Welding Company, Electric Welding Machine Company, Fusion Welding Corporation, General Electric Company, Una Welding and Bonding Company, USL Battery Corporation, Westinghouse Electric and Manufacturing Company.

The exhibits of electric resistance welding equipment were found in the booths of: The American Electric Fusion Corporation, the Acme Electric Welder Company, Elkon Works, Federal Machine and Welder Company, Gibb Welding Machine Company, Taylor Winfield Corporation, Thomson Electric Welding Company.

Another important division of the industry is the welding wire group. This group was represented by: American Steel and Wire Company, Central Steel and Wire Company, Chicago Steel and Wire Company, C. H. Hollup Corporation, Page Steel and Wiere Comany, John A. Roebling's Sons Company, Wickwire-Spencer Steel Company.

The Metal and Thermit Corporation had a large booth in which the applications of the thermit welding process were displayed and the fundamentals of the operation demonstrated.

Many of the working exhibits furnished the visitors with new demonstrations of the most recent developments in the welding industry giving a close-up view of the results of the research which has been carried on during the past year. The visitors who had not previously been well acquainted with fusion welding could not fail to gain a lot of useful information from the demonstrations which were provided.

The demonstration program of the Linde Air Products Company was exceptionally well organized. A number of interesting processes were demonstrated and these demonstrations were put on a definite schedule. Printed programs covering these schedules were distributed throughout the show. The program included the Stelliting of metal parts, welding monel metal, cast iron cutting, steel barrel welding with automatic equipment, welding air craft tubing, bronze welding, cast iron and welding cast aluminum. The automatic machine for welding steel barrels attracted considerable attention and demonstrated the possibility of fast production work with the oxy-acetylene flame when well designed automatic machinery for carrying the torch is provided.

The welding of cast iron with the bronze welding rod seemed to be another topic of absorbing interest. The American Brass Company had an exhibit of sample of actual work done, and in addition had a complete equipment set-up so that visitors could see the correct proceduure to be followed to get the right results with the process.

In the booth of the Air Reduction Sales Company the most interesting feature proved to be the operation of the oxygraph, a mechanically operated cutting torch. The ease of operation of this equipment, coupled with the big savings which are accomplished by using it in cutting heavy machinery parts from blade and bare stock, recommend this kind of equipment to a great many industries who have looked upon the oxy-acetylene combination as a welding process without realizing that production cutting in many cases means gas cutting, especially when heavy pieces are involved.

In the booth of the Keith Dunham Company a complete air liquefaction oxygen producing system was in operation. In the same booth there were displayed samples of steel pipe made into bends by a new process which yields a uniform diameter and uniform wall thickness without leaving any strains in the pipe. On account of the circular shape of these bends the only way to assemble them with straight lengths of pipe is by welding, but as this develops the full strength of the pipe it results in a lighter and more compact installation together with a smaller cost of making joints. Possibilitites of using these bends in many types of pipe work proved very interesting to many industrial engineers as well as to men in the welding industry.

The Federal Machine & Welder Co. showed a complete line of resistance welding equipment, one of the most interesting machines being an automatic buttwelder. Simplicity of operation, which consisted of putting the pieces to be welded in the welding jaws then simply pressing the lever, illustrated the great strides which have been made in perfecting this type of equipment, adding to the uniformity of the results obtained by it.

The two principal items of interest in the booth of the General Electric Co. were the automatic arc welding equipment for making seam welds in sheet metal shapes and the atomic hydrogen arc welding torch. A year ago this torch was a laboratory tool but its application has been studied during the past twelve months and on account of the number of interesting papers which have been written concerning the process there is much interest in seeing it actually work. The process as demonstrated in the booth is easy of application and promises to give some good results in a number of fields.

The Gibb Welding Machine Co. had in operation their latest types of resistance seam welding machinery. To anybody who associated seam welding altogether with tank making it is surprising to learn the great number of sheet metal products which can be assembled by this process and still would not come under the classification of tank work.

In the booth of the Westinghouse Electric & Manufacturing Co. arrangements were made to demonstrate the making of joints in structural steel. Engineers of this company have developed new designs for structural steel connections which favor the use of welding and during the show some connections of this sort were assembled in the booth.

The Fusion Welding Corporation, in addition to demonstrating equipment in its booth, had a small lecture hall where moving picture lantern slides and projectors were used to illustrate the influence of the choice of welding wire on the action of the metal.

The above items are just a representative group of the high spots of the welding section in Exhibition Hall. It would take more space than is available to attempt to make record of all of the information concerning the welding processes which could be obtained by visiting the show room at any of the sessions. It is probable that very few men who visited the show came from plants where welding is not being done but since the work in their plants is usually restricted to certain lines it is easy for them to have had a very narrow view of the possibilities of the work of welding. Here was an opportunity for them to see the different processes in use on practically all commercial metals in a great variety of shapes, sizes and combinations. A great deal of the work displayed was illustrative of new discoveries made since the last exhibition of equipment and supplies, such as welding wire, which have been perfected during that period and were just ready for announce-

ment. Interviews with a number of exhibitors indicated that interest in all of these new products was very keen.

During the week arrangements were made to hold the 1928 Fall Meeting of the American Welding Society and also the exhibit of the welding and cutting processes at Philadelphia in connection with the National Metal Expósition, the second week of October 1928, the name of the National Steel and Machine Tool Exposition having been changed to the National Metal Exposition. Arrangements are now being made for next year's meeting and indications are that most of the exhibitors who showed their products at Detroit will be on hand at Philadelphia.

The meetings of the American Welding Society which were held at the Book-Cadillac Hotel throughout the week reviewed the activities of the Society during the past year and provided technical papers on important branches of the welding industry. Nearly 300 members of the Society registered during the week. The principal papers of the technical sessions bore directly upon the fields for welding which came under the classification of production work; that is the use of welding as a manufacturing process and a fabricating process. It is in work of this nature that the industry has its best chance of expansion and most of the research activities in the industry are directed toward perfecting the different processes for their application to work of this nature.

DRAWN SHAPES READY FOR WELDING

During the past ten years the art of welding has brought a number of important changes in the manufacturing processes used for the production of many lines of metal goods. The use of welding has resulted in lowering the fabricating cost, reducing the weight and often improving the appearance of the finished article. The progress in production welding was slow at first because it was necessary to show the reliability of the process but consistent study of results obtained has showed it to be perfectly reliable. Consequently the welded article is accepted by the public as being sufficiently strong. The Janney-Steinmetz Company, 1421 Chestnut Street, Philadelphia, has been in close touch with this development and offer a line of products which appeal strongly to manufacturers who desire to make use of welded joints. These products are drawn shapes for assembly work in connection with welding a finished job. These shapes can be neatly assembled to other sections by welding and the finished result is a smooth, neat and accurate assembly.

RED CROSS TO CANVASS NEW YORK MACHINERY FIELD ON ANNUAL ROLL CALL

The entire metals and machinery field in New York City will be intensively covered in the 1927 Red Cross Roll Call, according to the plan of representative leaders, who, as volunteer chairmen of specially organized groups, are already formulating a comprehensive Roll Call program.

John A. Topping, chairman of the board, Republic Iron & Steel Company, heads as chairman the Iron and Steel group; F. L. Ward, treasurer of the Babcock & Wilcox Co., heads the Boilers, Engine and Machinery group; Charles Hayden of the Hayden-Stone Co., assisted by E. N. Skinner, heads the Mining, Smelting, Pig Iron and Brass group, and Samuel B. Donnelly, secretary of the Allied Building Metals Association, heads the Bronze and Allied Metal Industry group. A similarly organized Structural Steel group will also be formed.

The vast volunteer organization of the metropolis to secure the superlative response throughout the city of the annual membership effort will number representatives of every phase of New York's industrial, mercantile and professional life. Following the program which has operated with notable results in previous years, the huge volunteer alignment will be based on the plan of widespread committee groups to carry the Roll Call message into every branch of trade and industry and by opening of the Roll Call on Armistic Day it is estimated that approximately 200 such groups will be in action, each under the leadership of an outstanding figure in the field to be covered by the individual group.

The chairmen of the groups covering the Metals and Machinery field anticipate generous support for the forthcoming appeal and aim at a unanimous enrollment of the personnel throughout their field.

Included in the outstanding activities of the Red Cross, for whose adequate maintenance the annual membership invitation is extended to every resident of the city, are the disaster relief and public health program under which thousands of surgical dressings are supplied to local hospitals each year and which also covers nursing service, first aid, and work in home hygiene and care of the sick. Disabled ex-service men and their dependents are a large factor in the Red Cross program and activities on their behalf include legal assistance, money loans, and medical attention.

WELDING CONFERENCE AT PURDUE IN DECEMBER

Announcement has been made that plans are under way for a Welding Conference at Purdue University, Lafayette, Indiana, and that the tentative date has been set for December 13th, 14th and 15th of this year. This is the third sucessive year that welding has been made the subject of a three-day conference at Purdue. Industrial plants from the entire state of Indiana are invited to send representatives to attend this conference and in order to save time of these men, the program includes morning, afternoon and evening sessions. Papers are provided on all of the welding processes and their different applications in industry. Time is also set aside for a round-table discussion of important welding subjects. The conferences which have been held during the two preceding years have had large attendance and the visitors have always expressed themselves freely as being very much gratified with the value of the program.

Book Review

CAPTAINS IN CONFLICT, by Robert R. Updegraff.

It is not often that one finds oneself thoroughly engrossed in a novel that is practically devoid of romance—that is, of the handsome lover and beautiful maiden variety—or of adventure, dealing with physical combat against man or the elements. "Captains in Conflict," by Robert R. Updegraff, is neither a love story nor a book of explorers or soldiers of fortune, yet it is brimming with romance and adventure that will make you read past bedtime. Romance of a great industry in the epochal quarter-century just past, and the adventure of launching mammoth consolidations and of keeping smaller enterprises alive in the face of competition of the "trusts."

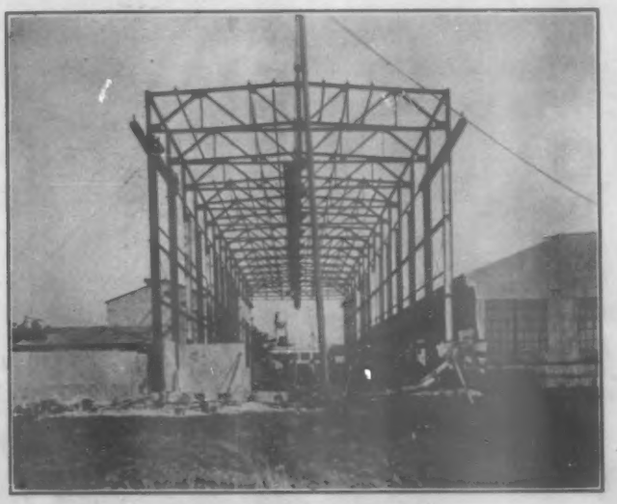
Beginning in the days when executives still laughed at those new fangled writing machines, and at the idea of a woman to operate them, down through Roosevelt's "trust busting," the reckless war days, and the post-war readjustments, the story carries one along past a panorama that brings out in bold relief the lessons learned by business and industry in this greatest period of commercial activity in the world's history. There are hours of suspense that remind one, too, that we have not left the days of buccaneers and chevaliers behind us.

The older business men will enjoy "Captains in Conflict" for the recollections it will arouse. The younger business generation will find in the story a wealth of inspiration to tackle the big jobs still undone. 285 pages. A. W. Shaw Company.

ARC WELDED BUILDING IN BERKELEY, CALIF.

Necessary enlargements to their plant to take care of a rapidly expanding business has permitted the Berkeley Steel Construction Co., of Berkeley, Calif., to have the distinction of erecting the first electrically welded steel building on the Pacific Coast.

This addition is a shop of 50 feet by 250 feet, carrying two ten-ton capacity cranes to facilitate the handling of large tanks which they manufacture in quantity. The structure is entirely welded, no bolts or rivets being employed. Drop tests were made on the trusses up to forty tons and they were found to be without the slighest indication of fracture after tests. The erection has been closely observed by structural engineers in view of the possibility of this method becoming the accepted form of construction of the future, and, it was in fact, with this idea in view that the Berkeley Steel Construction Co., decided upon a welded erection. Having since their incorporation, four years ago, turned out over 5,000 tanks, 75 per cent of which were welded, they are strong advocates of welding and it was decided that they could do



Framework of Welded Building.

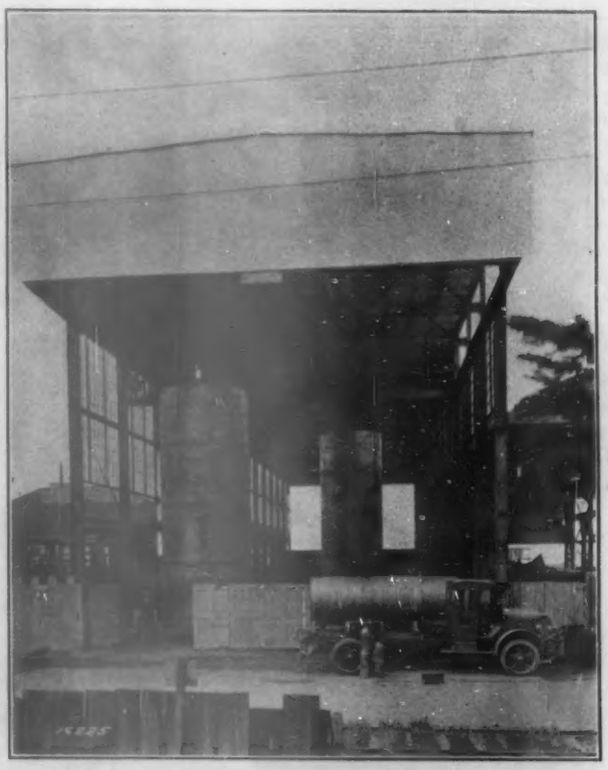
much to advance the cause of this fabrication by just such a project.

The trusses were completely welded on the ground and hoisted to position where they were held with pins until connecting welds with columns were completed and then withdrawn. No special care in handling the trusses into position was necessary as it was found that all the rough handling did not shear or crack any of the welds. A riveted truss under similar circumstances would have sheared the rivets or torn the members apart at the rivet holes. Columns up to the crane rails were 15 inches, 38½ pounds, for distance of 35 feet. Above the crane rails they were H columns, 11 feet high, 7¾ inches, 23½ pounds, supporting the trusses which were 46 feet 2¾ inches across, weighing over two tons each. Fourteen of such spans comprised the structure. "Continental" electrodes were used exclusively on the work.

These trusses support two 10-ton cranes each 21 feet 1½ inch center line of rails. There being no center columns in the structure, special care had to be exercised in the design of this truss in order to assure its being capable of carrying the center crane rails safely. This factor is the greatest test of the efficiency of the electric welding in the structure, as they were tested for double the load they were required to handle.

The cranes at either end of shop are overhung on cantilever beams for a distance of 9 feet from center line of last column to center line of crane. Cantilevers are of the built-up type continuously welded for a distance of 3 feet each end and with intermediate welds at 6 feet centers. Total over-hang on cantilevers is 13 feet. The end of the cantilever beam also supports the end frame of the building. This was also tested with the cranes both in the outward position and with full loads, which fact is also considered a thorough test of the efficiency of the welding process.

Roofing and sides of the building are galvanized corrugated iron, that portion of the sides below the level of the crane rails are of glass set in steel frames welded to the columns, assuring a maximum of light



Completed Building Showing Crane Tests.

The Berkeley Steel Construction Co., is a closed corporation with Mr. T. S. Neilson, President and General Manager and Mr. D. S. Neilson, Vice-President. Since its incorporation, four years ago, it has doubled its output every year. It, at present, occupies 2½ acres with 30,000 square feet under cover and men are still enlarging one of the smaller shops while production is carried on below. An average of seventy men are employed and the company is already doing a considerable amount of export business.

INTERNATIONAL ACETYLENE ASSOCIATION MEETS NEXT MONTH

. Announcement has been received that the Annual Fall Meeting and Convention of the International Acetylene Association will be held in the Stevens Hotel, Chicago, November 16th, 17th and 18th. This meeting brings together annually the leading manufacturers in the oxy-acetylene industry and gives them an opportunity to sum up the progress which has been made in the industry during the past year and the developments which promise to pave the way for further expansion. While details of the program are not yet ready for publication, it is understood that a number of interesting technical papers will be presented, furnishing topics for interesting and instructive discussions.

ELECTRIC WELDING IN MAINTENANCE*

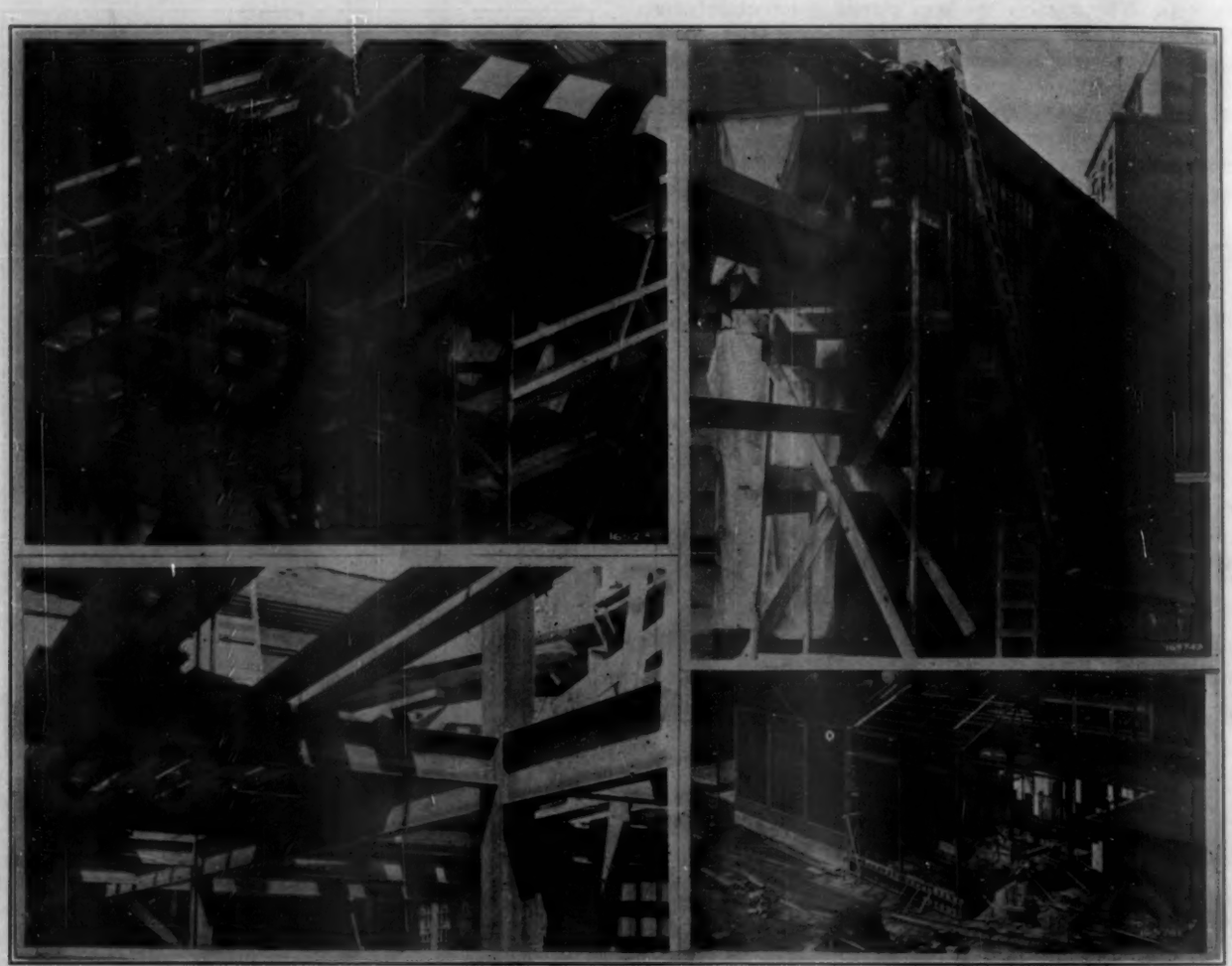
By J. E. Webster†

Electric welding has, by its own merit, worked its way into our Maintenance Department until we now have four operators and four portable welding sets. The work done is largely new work or additions to existing structures.

One of the difficulties to overcome in getting efficient maintenance work is the great variety of tradesmen required to complete a given job. In order to overcome this, we have for years done a lot of steel erecting with our carpenters but until welding came in detail drawings were necessary and the steel had to go through the fabricating shop.

It is our present practice to make up a bill of material from drawings and purchase the steel cut to length. The steel is delivered directly to the shop and the carpenters and welders do the complete erection. Any necessary cutting to correct for variations in the dimensions as found after steel is uncovered can be taken care of by the cutting brick with very little additional trouble.

Our operators are carpenters who have been given two or three months training in our welding school. They are therefore equipped to do welding or carpenter work as required. The average job requires that one-third the number of men on the erecting job should be welders in order to efficiently use the other two-thirds. We estimate that we save one-third of the drawing room time by eliminating the detailing, and from 10 per cent to 20 per cent of the complete job. I believe this to be a conservative estimate, as hold-ups are almost entirely cut out. A resourceful foreman can take care of conditions as he finds them.



Top Left—External Framework for New Elevator Penthouse on Office Building. More New Steel Is Inside the Old Roof. This Job Went Ahead with Absolutely No Delays.
Lower Left—Portion of Addition of Third Floor, Forty Feet in Length, to a Two-Story Brick and Steel Laboratory Building. The Building and Extension Is of the Flatiron Type Making Irregular Steel Connections Numerous.
Right—Addition of Two Bays to an Existing Building. Note Small Amount of Brickwork Cut Out to Make Connections to Old Columns.

Since using welders, however, it has not been necessary to get as accurate measurements and hence a great saving is made of the draftsmen's time and also the big chance of errors in dimensions of the fabricated steel have been avoided. Drawings of course are made showing sections of steel to be used and welding required. You all know the difficulty in getting measurements of structures of sufficient accuracy to fabricate new steel to be used in additions or extensions of old structures. This is especially difficult where the old steel is bricked or concreted in.

Some clip angles are of course necessary for lining up the work. These are welded to the supporting member and the necessary bolt hole is burned in the beam with the torch. In case of purlins small spacing clips are welded to the top of the truss against which the purlins are placed before welding.

The smoothness and promptness of the completion of these and many other jobs has convinced us that the welding art has become a great time and money saver in maintenance work.

**Discussion before Fall Meeting of American Welding Society at Detroit, Mich., Sept. 22.*

†Works Engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

NEW FEATURES IN THE CONSTRUCTION OF THE MAGNOLIA PIPE LINE

Three years ago the Magnolia Gas Co. of Dallas, Tex., started a pipe line project that has marked a new era in the construction of gas trunk lines. On June 1, 1924, a telescopic and continuously welded line of 14, 16, and 18-inch pipe was laid from Northern Louisiana to Beaumont, Texas, a distance of 217 miles. Such a project was the first successful attempt to weld a large diameter pipe line over a long distance. No better evidence of its success is demonstrated than in the fact that the same company is constructing a similar line from Louisiana fields to Dallas and Ft. Worth, a distance of 210 miles.

Because of the high pressure under which the line is operated and because of the speed with which the gas goes through the line, the designing engineer feels that the results accomplished could not have been obtained had it not been possible to weld the pipe used.

Gas is transported through the line at a speed of 40 to 60 miles an hour and with much higher pressure than that used in the operation of other main lines. The capacity of the line is 65,000,000 cubic feet of gas per day. This is because the design of the line and the welding permit the gas to be sent through at a much higher velocity than heretofore. Construction was carried on under unusual climatic and geographical conditions, giving rise to a number of welding problems.

The decision to weld the line continuously instead of using couplers, as had been common practice on other large lines, was reached after a careful study of the territory through which the line was to be built. The quicksand and the decomposed soil, and the fact that a large portion of the line would be under water several months during each year, and that miles of the line go through boggy swamps made more difficult to penetrate because of the dense growth of underbrush and trees, all played an important role in the decision to lay a continuous welded line. Furthermore, although the first line was more or less an experiment in the eyes of the gas industry, no serious defects developed during the construction or have developed after two and a half years of operation, to warrant any major change in the design and construction of the second line. The results obtained on the first line have been most satisfactory.

Of the many problems encountered in the welding of large diameter pipe that of burning the joints is of paramount importance. Many of the problems met with in the welding of large pipes are not common to lines of 10-inch and smaller pipe where, the line being more flexible, a poorly welded joint may hold. But the same character of weld on a larger diameter pipe would break. Because of that reason, every precaution was taken to eliminate so far as possible a poor weld.

On the Beaumont line, to insure the competence of the welders a welding school was opened at the refinery. More than 400 students were enrolled and the result was an adequate supply of skilled welders. When the second line was started, this year, it was found that competent welders are now comparatively easy to obtain, and such a school was not necessary.

The line was laid in sections of 2,500 to 5,000 feet, and each section tested by hammering the welds and inspecting with soap suds while under 100 lbs. air pressure. Defective joints, which were few, were rewelded. The welder's number was stamped on each weld, which proved an effective check on the work of the operators. In addition, a specially designed cutting machine was used to cut out a section one-eighth of an inch wide at right angles to the weld at intervals, as a check on workmanship.

Each section is roll welded, a section ranging from 5 to 20 joints. The welding crew cuts out the tack welds as they come to them in welding around the pipe. Starting together, the crew would weld a quarter of the circumference of the pipe. All welders finished their quarter weld at the same time and the rolling gang turned the pipe a quarter turn for the next weld. After a section had been welded, it was rolled into place, blocked up to hold the slack, and tied into the completed portion of the line.

The generators were mounted in three batteries of two 100-lb. generators each. A number of 50-lb. generators were also used. Much of the time it was necessary to transport this equipment on skids on account of the swamps and quicksand. Not only the nature of the country but the terrific heat slowed up the progress of the work, the men being obliged to work in the shade of umbrellas.

Many of the sections had to be welded on high ground and floated across the swamps or dragged through quicksand and rotten soil by tractors. Superintendents in charge of construction point out that had the line not been welded it would have been impossible to lay it, except where the soil could be ditched, to insure against its being pulled apart at each joint where there was a tendency to float the line.

Sudden rise of rivers in some places carried the pipe bodily 40 or 50 feet away from the position in which it had been laid. Such a strain on the line did not cause it to break, however, and no trouble was experienced in dragging the line back into position for trenching. This is just one instance of the severe strains placed on the line, but its strength invariably held.

Particular caution was taken to insure all of the slack being lowered with the pipe into the trench. The entire line was lowered under 100 lbs. pressure, and then finally tested under 650 lbs. pressure. This lowering of the line under compression would have been impossible with any other than a welded joint. Lowering does not start until the work has progressed to a point far enough in advance so that the resistance will not allow the slack to creep forward and escape.

Proper supervision of welding operations and of the mechanical considerations in the laying of the line have resulted in a large diameter pipe line that operates at record capacity, through country where repairs would be difficult and costly, with hardly a trace of leakage after nearly three years of service.

(*From a recent article in the Oil and Gas Journal.*)

EAST CHICAGO AND INDIANA HARBOR HOLD INDUSTRIAL EXPOSITION

Under a great tent in their industrial district the industries of East Chicago and Indiana Harbor, Indiana, displayed their products to the consumers in that territory, during the week of October 26th. Among those showing products made in their local plants were Crane Company, Calumet Iron & Metal Co., Graver Corporation, Grasselli Chemical Co., Hubbard Steel Foundry Co., and Universal Portland Cement Co.

Acme Oxygen Booth at East Chicago Industrial Exposition.

Acme Oxy-Acetylene Company occupied a booth in which they displayed their tanked oxygen and acetylene made in their East Chicago plant; also Shawinigan Carbide, Rego torches and regulators, and welding wire.

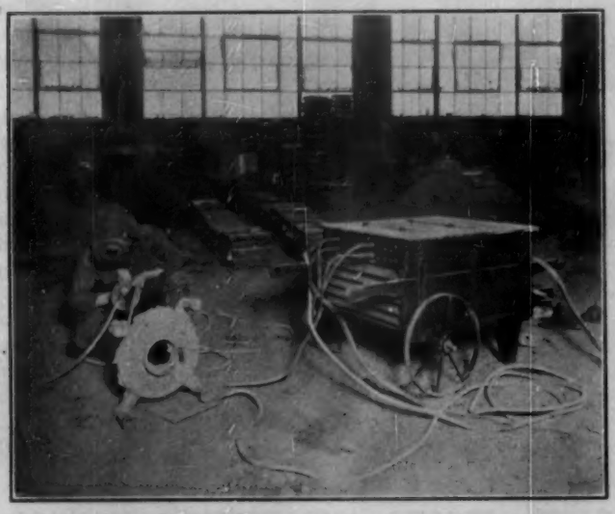
CUTTING OF STAINLESS STEEL CASTINGS

By C. J. Holslag

Much has been written about the welding of stainless steel, as each particular alloy and application thereof has its own problem as to the welding of this new rustless alloy.

Some are welded best with gas, some with electric D. C. and some with A. C. In general, as to electric welding, D. C. is best with the copper base rustless alloys and A. C. for the chrome and nickel base alloys.

A new problem has arisen because of the increasingly prevalent use of this new line of alloys and that is the cutting of the gates, risers, frings and overflow on castings. Several firms have found that it would hardly pay to take on the casting of these alloys if ordinary methods of cutting were to be used because either by drilling or by sawing or with a high speed cutting wheel the cost of getting the casting to machinable shape is prohibitive.



Arc Cutting on Stainless Steel Risers.

These castings are tough and hard, and good tools rapidly are worn out. Gas is difficult to use in cutting many of the alloys, but it is readily accomplished with the electric arc, so that not only can gates, risers, fringe and overflow be cut off very quickly with the minimum of power, but the castings can be smooth and ready for machining. Very little grinding has to be done and this without changing the temper or quality of the casting.

Photograph shows the installation, and in the background will be noted the electric furnace from which the casting was poured. This brings into direct view the fact that electric power is easily obtainable from practically every point where such a casting would be made. The same machine is made so as to be adapted for all welding as well as cutting.

ALLIANCE TANK COMPANY EXPANDS

The Alliance Tank Company announces an increase in authorized capital stock from $60,000 to $95.000. This company was organized May 19, 1926, under the laws of the State of Ohio, for the purpose of manufacturing steel tanks and miscellaneous plate work, using the welding process.

Officers are:

E. L. Coble, president and General Manager.

A. L. Haidet, Vice-President and Treasurer.

George E. Harding, Secretary.

Alvin Haidet, Director.

J. R. Quick, Director.

How thoroughly this company believes in the economy of arc welding is demonstrated by their new plant. The building is of all steel construction, including roof and siding. The roof is of 22 gauge corrugated copper bearing steel and the siding is of the same material but of 24 gauge. Electric welding was utilized in fastening the corrugated steel sheet to the structural members. All the interior fittings, such as brackets, bracing, line shafts, hangers, etc., were electric welded, Lincoln equipment being used.

Welding Sides to Structural Members.

This company specializes in gasoline oil storage and pressure tanks, vats, oil pits for filling stations, paint kettles and varnish tanks, distributed under the trade name of "Thoroweld" tanks.

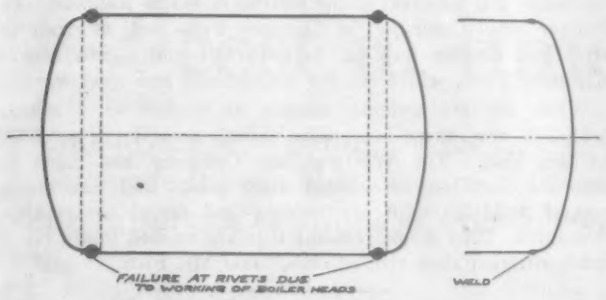
TWO LARGE SAVINGS EFFECTED BY WELDING IN ONE SMALL POWER PLANT

Seventy-five per cent of the cost of a new boiler was saved for the power plant of the Borland Manufacturing Building, Chicago, by cutting out with the torch the sections where failure had occurred and then welding the three remaining sections together. "Breathing" action of the heads had caused bad leaks by loosening the rivets. The overlapping riveted section of plate was cut away as indicated by the dotted lines in the drawing, and the heads then butt welded to the shell inside and out with the electric arc. In cutting out the riveted section as much as possible of the curvature of the heads was retained so as to avoid a sharp corner at the weld.

Not only would a new boiler have otherwise been necessary, but considerable labor would have been involved in removing the old boiler and installing the new one on account of the inaccessibility of the location. The entire cutting and welding job cost about one-fourth of the cost of a new boiler, and the life of the present boiler has been lengthened many years.

Another example at this same plant of how equipment can be kept in service by taking advantage of welding, is found in the replacing of inner "false heads" in a water heater. Both heads, which had developed large cracks, were cut out with the torch about four inches inside the shell. These heads

were then used as templates in drilling holes for 36 2-inch tubes in the new heads, which were 4 inches larger in diameter. A slot 2 inches deep was cut on each side of the flange still attached to the shell, and the heads slipped through these



Welding Repairs on Riveted Tank.

slots to the inside of the heater, so that the flanges would overlap the heads 2 inches around the circumference. The heads were then arc-welded in place.

ELECTRIC PIPE WELDS STRENGTHENED BY ANNEALING

In the construction of a 36 inch arc welded pipe line, the pipe was fabricated of ½ inch plate on the field. The mill tests on this plate were reported to be:

Yield point, 33,700 lb. per sq. in.
Tensile strength, 54,600 lb. per sq. in.
Elongation, 31.5 percent in 8 in.

The edges are bevel-shaped and the plate bent to the required diameter. Two rods are placed parellel to each other in the V, while a third rod, the electrode, is held in the traveling head of the machine. These two extra filler rods increase the rate of deposition in the longitudinal seam. The lower support is grooved directly under the V to allow reinforcing of the weld on the inside of the pipe.

The Iron Age (Aug. 25th) shows several microphotographs of the welded plate, in the weld, at the point of fusion, and at various distances from the weld, before and after annealing. The structure after annealing shows a great improvement in crystal size and arrangement between weld metal and plate.

Before annealing, and before the hydro-static test of the line, 6 by 18-in. test specimens were cut from the weld in every tenth section. The tension tests showed (as an average):

Yield point, 29,100 lb. per sq. in.
Tensile strength, 44,300 lb. per sq. in.
Elongation 9.3 per cent in 8 in.

These tests indicate the extent to which the welding process has reduced the strength and ductility of the original plate. A line previously laid without annealing also showed the effect of welding heats by breaking in several places when tested, most of the breaks occurring near the weld.

When part of a structural member is heated sufficiently to produce crystal growth and the remaining part has had no crystal growth produced by heating, a physical condition is created which results in internal stresses. This condition exists in most welded material as welded and may be effective anywhere within five inches of the weld, depending somewhat upon the thickness of the metal welded and the intensity of the heat. Some form of heat treatment is obviously required for the elimination of these internal stresses and the improvement of the structure of the weld itself.

There are many cases where electric arc welded material can be safely used as welded, without any normalizing process. Where high pressures are to be carried, however, or where the joint is subjected to other severe strains or to vibrations, suitable heat treatment will greatly increase the safety factor and will more than justify the additional cost.

To determine the effect of heat treatment, the usual test strips were cut from the welded plates. These were brought up to 1,580 deg. Fahr. in 90 min., held for one hour, allowed to cool to 800 deg. Fahr., removed from the furnace and cooled to room temperature. The test results then obtained were:

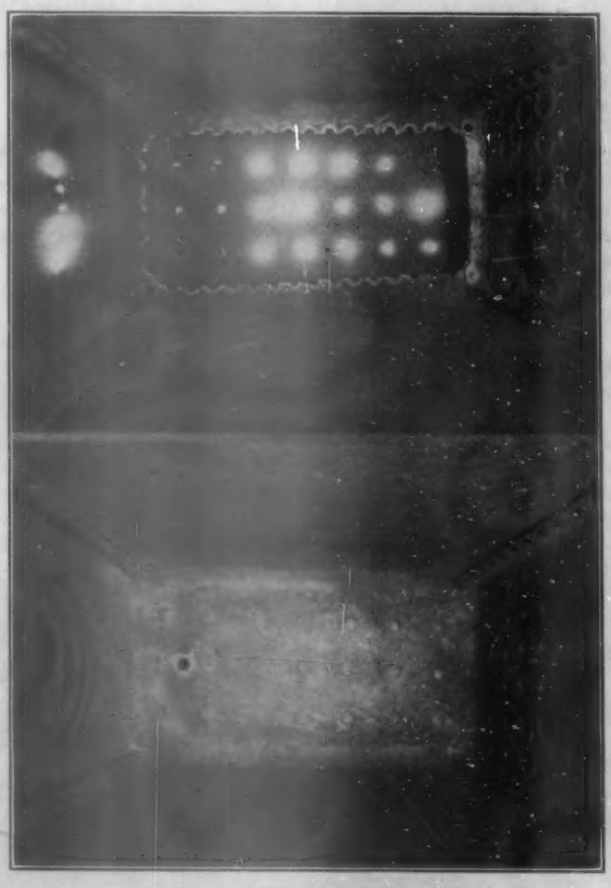
Average yield point, 31,300 lb. per sq. in.
Tensile strength, 50,900 lb. per sq. in.
Elongation 22.65 per cent in 8 in.

This shows a marked improvement over the specimens tested as welded, and compares favorably with the strength of the original plate.

BOILERS, STACKS, AND CASTINGS, ALL IN THE DAY'S WORK

An enterprising welding shop is called upon to handle about as wide a variety of jobs as can be found in any kind of a shop anywhere. These from a welding shop in Hot Springs, Arkansas:

The cracked crown sheet of a steam roller was cut out and the half holes welded up. The new sheet was welded in by the "back step" method, using the torch on account of the



A Neat Boiler Welding Job.

small space in the firebox. This job has been well tested, having been in continuous service for two years. Recently it was fired up with low water, but little damage was done. After replacing some stay bolts it was put back into service.

A similar job was done on the firebox of a narrow gauge locomotive. The old box was taken out by cutting the door

collar where it joins the door sheet, all stay bolts having been cut from the outside. The sheets were laid out and drilled and then reasembled with the inner corners just touching. A heavy 90 degree weld was then made up to the crown. The shop having no rolls, lines were chalked three inches apart on the wrapper sheet and two torches played on one line at a time until the sheet had rounded to shape. The rest of the box was then welded on the outside, using a heavy bead, and a single bead run around the inside. After bolting the box in place, the door collar was welded. The job was tested with 100 pounds steam pressure, and no leaks whatever developed. The entire job was arc welded by the back step method.

Another job was the welding of a 42-inch stack, 100 feet high, inside of a square brick ventilator shaft. The stack was rolled in 4-foot sections and the longitudinal seams welded in the shop. From a gin pole on the roof the sections were lowered one at a time into the brick shaft, and were butt welded on the inside, with angle iron rings welded every three feet. The first 32 feet were of ¼-inch sheet, the next 32 feet of ⅜-inch, and the balance of 10 gauge. The breeching, which was 3x4x42 feet of 12 gauge material, was corner welded and hung on angle irons eight feet apart. No reinforcing was found necessary. The breeching was welded into the stack. This job was also electrically welded.

This shop has had considerable success with welding cast iron with the electric arc. As an example of what they have accomplished with careful operating, they welded a large crack in a 400-lb. casting which contained two babbitted bearings. In spite of the fact that the welding included the boss in which the babbitt was poured, the bearings were not affected by the welding process. This casting has been in service six months since the repair was made.

FIRST ARC-WELDED BRIDGE TO BE BUILT

An arc-welded, rivetless steel railroad bridge, the first of its kind to be built, is to be erected on the line of the Boston & Maine Railroad at Chicopee Falls, Mass., according to an announcement by Gilbert D. Fish, consulting structural engineer for the Westinghouse Electric and Manufacturing Company.

"Contracts for this revolutionary type of railroad bridge have been signed," said Mr. Fish, "and construction will proceed at once—completion is expected about January 1st.

"The bridge, when finished, will be practically a one-piece structure since every joint will be welded solid and immovable. Weaknesses due to movable joints and rivet holes are thereby eliminated. As a result, the welded bridge is lighter than a corresponding riveted bridge to carry the same load and costs less. A longer life is also expected, particularly in the case of the floor construction.

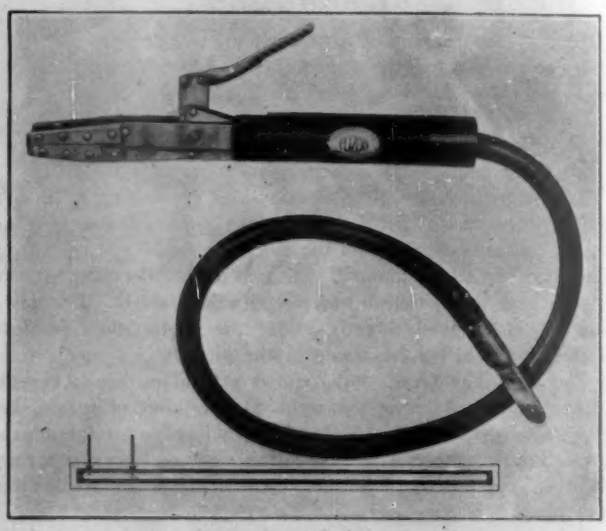
"Only 80 tons of steel are needed for the welded job," said Mr. Fish, "whereas 120 tons would be necessary if the job were riveted."

The bridge, which is to be 175 feet long, will span a water-power canal at Chicapee Falls, Mass., and will connect the local Westinghouse plant with the Boston & Maine Railroad, thereby eliminating trucking to the freight station. It is being constructed by the Westinghouse Company with the co-operation and approval of the Boston & Maine Railroad. The Palmer Steel Company, of Chicopee Falls, will fabricate the steel and do the welding, and Tarbell and Leete, also of Chicopee Falls, will erect the foundations and steel work.

While the arc welding process as applied to a railroad bridge is new, there is nothing experimental in it, according to Mr. Fish. The Westinghouse Company has made exhaustive tests on arc-welded steel joints and has erected several buildings with arc welding and tested the resulting structures. "No doubt remains that arc welded joints can be made stronger than riveted ones," said Mr. Fish.

NEW FEATURES IN ELECTRODE HOLDER

A unique holder designed for all classes of electrodes, especially for surfaced electrodes, has been produced by the Fusion Welding Corporation, Chicago. It is claimed for this holder that it gives perfect contact under all conditions, that it minimizes overheating of the electrode, and that spattered weld metal will not stick to the holder jaws. When the



New Fuzon Electrode Holder.

electrode is placed in the holder the jaws clamp and the electrode is automatically pushed forward. This movement scrapes all surface materials from the four points of contact (as indicated by the arrows shown in lower part of photo), thus assuring the welder of a perfect contact, which eliminates overheating of the electrode.

Rivetless Steel Bridge to be Erected on Boston & Maine Railroad Near Chicopee Falls, Mass.

Returned to Service at minimum cost in time and labor

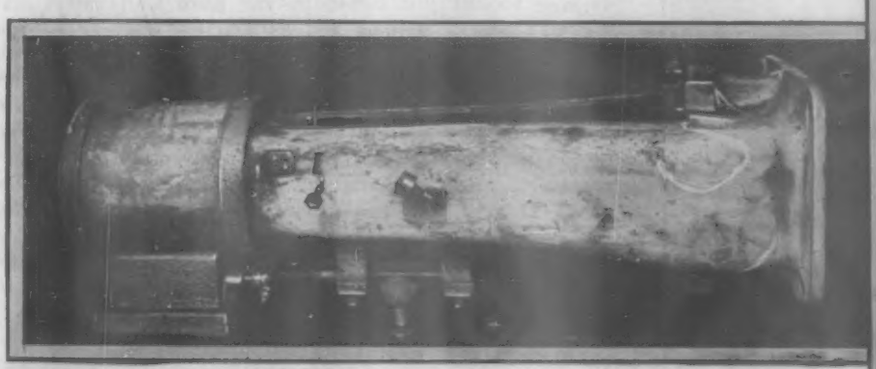
TOBIN Bronze Welding by the oxy-acetylene process made it possible to return this cracked engine casting to service as strong as ever in two hours and a half.

Because Tobin Bronze flows freely at 1650°F., complete dismantling for preheating in a furnace was unnecessary. The low temperature used also prevented distortion of the casting.

The great strength of the welds, together with the saving in time effected by the elimination of extensive preheating, makes Tobin Bronze Welding the logical method for many production operations as well as for repairs.

Tobin Bronze, manufactured exclusively by The American Brass Company, may be obtained from leading distributors of welding equipment and supplies.

THE AMERICAN BRASS COMPANY
GENERAL OFFICES: WATERBURY, CONNECTICUT
Offices and Agencies in Principal Cities
Canadian Mill: ANACONDA AMERICAN BRASS LIMITED, New Toronto, Ont.



Cracked engine casting in position for Tobin Bronze Welding.

As repaired with Tobin Bronze by the Oxy-Acetylene Process.

TOBIN BRONZE

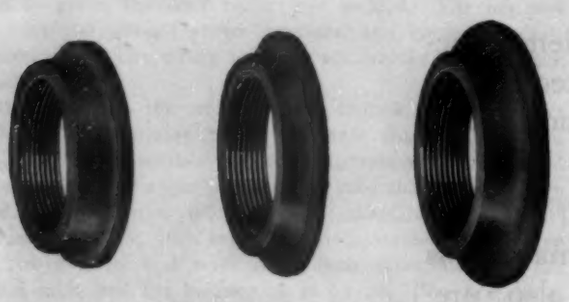
REGISTERED U.S. PATENT OFFICE

WELDING RODS

EXCLUSIVELY AN ANACONDA PRODUCT

COMPLETE LINE OF WELDING FLANGES

Bonney Forge & Tool Works, Allentown, Pa., have recently developed a very complete line of flanges for use by manufacturers of tanks, boilers and steel containers, and also for use by welding shops in the making of difficult repairs. There are different lines of these flanges, of varying weight,

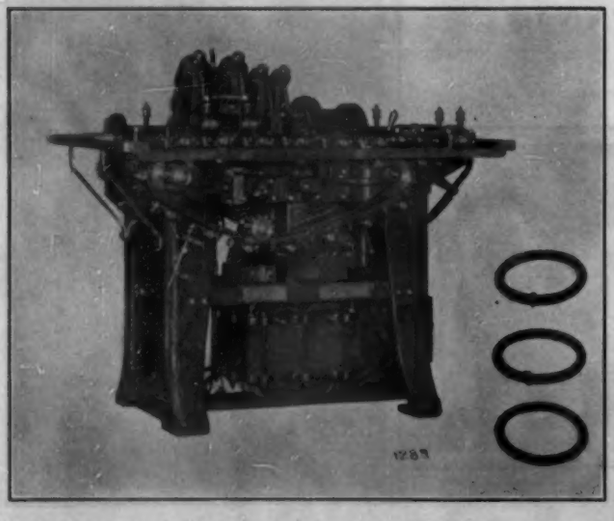


Welding Flanges in All Sizes.

thickness and method of attachment, and all of them are made in the regular pipe sizes from one-eighth inch to four inches, inclusive. Complete charts showing various dimensions, sizes, etc., are available.

AUTOMATIC RING WELDER SPEEDS UP PRODUCTION

This machine has been designed especially for manufacturing harness rings and will turn out approximately 30 rings per minute, as compared with a production of 6 to 10 rings per minute for the ordinary hand operated butt welder. This increase in production shows what may be accomplished in



Thomson Ring Welder.

welding through the use of specially designed automatic machines.

This particular welder, built by the Thomson Electric Welding Co., Lynn, Mass., not only makes the weld, but passes the welded ring along to a striking die that flattens out the flash and the ring is then carried along to a trimming die that shears off the flash. The rings shown in the photograph illustrate the three different operations.

The operation is fully mechanical, i. e., clamps, pushup, current control and burr removing device are full automatic. The operator merely inserts rings and jigs mounted on endless chain at front of welder. Clamping, welding, burr removing and ejection of finished rings follows in sequence named. The operation is continuous.

Rings from 1¼-inch I. D. to 2½-inch I. D. of wire from approximately ¼-inch to $\frac{7}{16}$-inch in diameter. Also rings from 2½ inches I. D. up to 4¾ inches I. D., made from wire up to $\frac{7}{16}$-inch diameter. One set of locating fingers for rings between ¼-inch and 2½ inches in diameter is required, and another set of fingers for rings from 2½ inches up to 4¾ inches in diameter.

HOLLUP ISSUES CATALOG OF COMPLETE ELECTRIC WELDING LINE

C. H. Hollup Corporation, Chicago, has prepared a sixteen-page catalog describing their full line of motor-driven and engine-driven portable and stationary arc welders, and also their coated and processed electrodes, as well as welding accesories, including a preheater, electrode holders, helmets and goggles, brushes, cables, and sand blast equipment.

HANSEN ARC WELDER HAS NEW FEATURES

Unique principles of electrical design are incorporated in the construction of the Hansen Arc Welder, manufactured by the Northwestern Manufacturing Co., Milwaukee. The chief feature is the elimination of the external stabilizer, the stabilizing principle being accomplished by the commutating winding. It is claimed that this results in deeper penetration, ease of starting and maintaining the arc, in addition to the obvious advantages of reduced weight, saving of energy otherwise wasted in a stabilizer, and one less piece of equipment to require attention.

The Hansen Welder can be obtained in single or multiple units, portable or stationary, motor- or engine-driven and with capacities of 200 amperes (giving a range of 50 to 300 amperes) or 300 amperes (giving a range of 70 to 400 amperes).

INSTRUCTIVE BOOK ON KORO JUST ISSUED

"A New Method of Bronze Welding" is the title of a 16-page booklet just issued by the Koro Corporation dealing with bronze welding and its practical application. Special note is made of the development of bronze welding and also the principle of the procedure since an acquaintance with these points will be valuable in its successful application. Its success depends on the constant progress of the work once it is started. The invention of the Koro process is mentioned and the advantages of its use. The booklet concludes with instruction in the use of Koro that the reader may make successful use of the new rod. A copy of the booklet may be obtained by addressing the Koro Corporation, Waukegan, Illinois.

MILBURN CO. OPENS NEW ENGLAND AGENCY

The Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, Maryland, manufacturers of welding and cutting apparatus, portable carbide lights, oil burners and preheaters, and paint and lacquer spraying equipment has organized an office in Boston to be known as The Alexander Milburn Sales Company, Wiggin Terminals building, 50 Terminal Street, Boston, Mass.

This office is under the supervision of Messrs. M. B. Crouse and G. B. Malone, both experienced executives in welding and cutting equipment. This office will handle the sale and distribution of Milburn Equipment throughout the New England States in a highly specialized manner.

The Alexander Milburn Company is enjoying a very good sale of its equipment in this territory as well as other parts of the United States and foreign countries.

NEWS OF THE WELDING TRADE

Mr. J. F. Lincoln, vice-president of the Lincoln Electric Company, has been elected secretary of the East End Manufacturers' Asociation of Cleveland, Ohio.

National Welding Company, of Denver, Colo., has been awarded the contract for arc welding of base of a steam engine at Swift & Co.'s power plant.

Work on the Lone Star Gas Co.'s 10-inch welded line from Abilene to Sweetwater, Texas, is now under way. The line will pass through Merkel and Trent, and later may be extended to Colorado. A force of 200 men will be employed.

Mr. Fred B. Loucks, formerly of Linde Air Products Co., is now an engineer in the service department of the Acme Oxygen Company, Chicago. Mr. Loucks has had many years experience as a process engineer.

The Wade Engineering Company of Los Angeles, Calif., who handle products of The Lincoln Electric Company, Cleveland, Ohio, announce that their Northern Office has been moved from 69 Webster Street, Oakland, to 533-539 Market Street, San Francisco. Increased sale of "Linc-Weld" motors and "Stable-Arc" welders has necessitated a much larger stock and increased space has been found necessary. The new location is in the heart of San Francisco, and will enable The Wade Engineering Company to render better and quicker service to their customers in the industrial district.

Since the consolidation of the Holslag and Arendt patents on alternating current arc welding joint licenses under the new patent are reported to have been issued to the Allan Welding and Manufacturing Co., of Buffalo, New York, The Gibb Welding Machines Co., Bay City, Michigan, Seneca Electric Welder Co., Seneca, Kansas, Welding Service Co., San Francisco, California, Electric Welding Machine Co., of Detroit, Michigan and Sieman Seneca Welding Corporation. of New York City.

S O S Welding Corporation, 502 Hamilton Avenue, Brooklyn, N. Y., engineers and contractors and specialists in the welding of tanks, pipe and steel construction, are fully equipped for the handling of important welding work requirements of industrial corporations, public utility and ship-building concerns, etc., from coast to coast. It will be recalled that an article covering one of their recent operations appeared in the August issue of The Welding Engineer. Contract work will be under the supervision of Mr. J. Kjekstad, Manager, an expert in the design and execution of welded construction work.

The September meeting of the Los Angeles Section of the American Welding Society, held September 29th, took the form of a visit to the plant of the Columbia Steel Corporation. The inspection trip gave the members an opportunity to view the operation of open hearth and electric furnaces and the large rolling mill operated by the company.

Announcement has been received that the Air Reduction Company, 342 Madison Avenue, New York, has purchased the oxygen plant and the entire business of the New England Compressed Gas Company, Boston, Massachusetts. This brings the total number of oxygen plants operated by the Air Reduction Sales Company up to thirty-five, all of them being located in or near important industrial centers of the United States.

At the Ninth Annual Convention and Exhibition of the American Gas Association, held in Chicago during the week of October 10th to 14th, gas welding and cutting equipment

For Sale

SCHRAMM

Portable, Gasoline Engine-Driven

Compressor

Indispensable for welding contractors, job welders, etc.

For operating chipping, drilling and grinding tools, etc.

Displacement of 60 cubic feet of free air per minute.

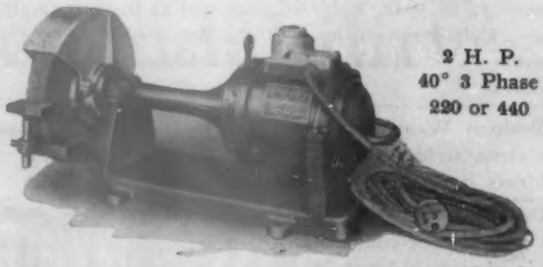
Also for sale: same type compressor, unmounted.

Welding Service Co.

50 Church St. New York City

STOODY COMBINATION GRINDER

AERIAL OR BENCH GRINDER ALL IN THE SAME TOOL



2 H. P.
40° 3 Phase
220 or 440

The adaptability of this Heavy Duty Grinder as a double duty machine greatly reduces the expense by the installation of one grinder instead of two, and is found extremely useful in both large and small shops.

The balance is so perfect, that when used as an Aerial Grinder considerable work can be accomplished in any position with ease and rapidity.

Equipped with 25 ft. extension cable, switch, polarity plug and receptacle, 14x2 in. grinding wheel, wheel guard, tool rests and heavy cast base for use as bench Grinder.

Write for further information

STOODY COMPANY

Whittier CALIFORNIA Oakland

"STANDARD"
Welding Wire
GAS AND ELECTRIC
A grade for each type of work—send for samples.

for sound permanent welds : : lower costs
Our costs are considerably under those of large industrial centers; ours is a one-profit wire sold direct to user from our own mills exclusively devoted to making of welding wire from raw material to finished product—hence our extremely low prices for wire that is definitely superior. Adopted exclusively by many large users.
Prices on request.
Standard Steel & Wire Co., Greensburg, Pa. (Mills at Bolivar, Pa.)

was exhibited by: The Linde Air Products Company, New York City, and the Imperial Brass Manufacturing Company, Chicago, Ill.

Arrangements are being made for an interesting program for the October luncheon of the Compressed Gas Manufacturers' Association, which is to be held at the Commodore Hotel, New York, October 20th in conjunction with the next meeting of the board.

Patents were recently issued from the United States Patent Office to J. F. Lincoln, of the Lincoln Electric Company, covering the welded steel motor frames in which welded steel construction has replaced castings. The claims allowed for the method of construction cover its use only to dynamo electric machines.

The Wilson Welder & Metals Company, Hoboken, New Jersey, recently issued an interesting eight-page booklet which discusses the process of welding copper, brass, monel metal, bronze, nickel, aluminum and gives some interesting information on how to secure machineable cast iron welds by using a monel metal electrode.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

For Sale—Style E Purox cutting torch; No. 20 Purox welding torch, tips 2, 3, 6, 8, 10, 12. No. 2 oxygen regulator, for cutting purposes. No. 2 acetylene regulator, for cutting purposes. 25 ft. ¼-in. 5-ply red hose and 25 ft. ¼-in. 5-ply black hose. Cylinder wrench. Outfit in good condition. Used six months. Cost $156.50 new. Ralph Linger, 3222 W. Jackson, Chicago.

Position Wanted—Have had 12 years' experience as oxy-acetylene welder. Married. Can give excellent references. Address Box 130, care The Welding Engineer.

Position Wanted—Thoroughly experienced welder and service man desires connection as service man with manufacturer or in charge of large job shop. 42 years old. Can furnish best of references. Will go anywhere in the United States for a permanent position. Address Box 131, care The Welding Engineer.

For Sale—A complete thirty cubic meter Messer oxygen producing and compressing unit which has been in used for three years. This plant is in first class condition and may be seen in operation. Wall Brothers Company, 929 Majestic Bldg., Detroit, Mich.

ANNUAL CLEARANCE SALE
OXY-ACETYLENE EQUIPMENT
Demonstration and exhibition samples
Milburn Welding and Cutting Outfits
Milburn Welding and Cutting Torches
Milburn Welding and Cutting Regulators
Milburn Welding Generators
at low prices for quick clearance—subject to prior sale. All apparatus guaranteed. Advise what you are interested in.
THE ALEXANDER MILBURN COMPANY
1416-1428 W. Baltimore St.,
BALTIMORE, MD.

WELDING ROD HOLDER
FOR THE OXY ACETYLENE WELDER
$1.00
ALL STEEL WIRE BRUSHES
SEND $1.00 FOR 5 ASSORTED BRUSHES
Money refunded on return of goods, if not what you want.
WRITE FOR DEALERS' PRICES
C. SORENSEN, 18 E. 16th ST., CHICAGO

REBUILT ELECTRIC WELDERS
The following are a few items in our large stock:
200 amp. Lincoln A. C. motor drive
200 amp. Lincoln belt drive
200 amp. Lincoln D. C. motor drive
200 amp. Lincoln gasoline engine drive
Every machine guaranteed
GOODMAN ELECTRIC MACHINERY CO., 126 Green St., Newark, N. J.

For Sale—One 300 lb. low pressure Duplex Type Acetylene Generator (400 lb. total carbide capacity) with equipment. Bridgeport Metal Goods Mfg. Co., Bridgeport, Conn.

Salesman Wanted—With executive ability who is familiar with and has sold oxy-acetylene apparatus. Preferably man who can demonstrate. Must be good closer. To the man who qualifies a real opportunity is open for a good future with company manufacturing complete line of high grade apparatus. Applications received by mail. Must furnish a car. Give full details of experience, reference and sales record, otherwise application will not be considered. Confidential. Write Box No. 128, care The Welding Engineer.

Shop Foreman—A man thoroughly experienced on electric and acetylene welding is wanted by a large New York City job welding shop to take full charge of all work. Previous experience must show signs of being able to handle this job. Excellent opportunity and good salary for the right party. Address Box 129, care The Welding Engineer.

AMERICAN STEEL ENGINEERING COMPANY
10 So. 18 St., Philadelphia
601 Granite Bldg., Pittsburgh

GE Arc Welders, GE Electrodes: TYPES A, B and F
Four Reconditioned General Electric Arc Welders. Price, $300.00 and Up.
Page-Armco Welding Wire and Electrodes
Write to nearest office for descriptive circular and prices

BURDETT

OXYGEN

Burdett is one of the oldest names associated with the commercial production of high purity oxygen. In many territories Burdett plants were the very first to serve oxygen users.

The plants listed below have all been long established, and all are managed by men who have had wide experience in oxygen production.

BURDETT PLANTS AND WAREHOUSES

Abilene, Tex. *Atlanta, Ga. Austin, Tex. Birmingham, Ala. *Chattanooga, Tenn. *Chicago, Ill.
Dallas, Texas *Detroit, Mich. *Ft. Worth, Texas Knoxville, Tenn. Lubbock, Texas
Nashville, Tenn. *Norristown, Pa. *Oklahoma City, Okla. Philadelphia, Pa. *Pittsburgh, Pa.
Wichita Falls, Tex. Ranger, Texas South Bend, Ind. Temple, Tex. Waco, Tex.

*Plants

USE BURDETT OXYGEN—It's the best

You Can Do It Better With TORCHWELD

for

DEPENDABILITY

Torchweld Equipment can be depended upon to cut your oxygen and fuel gas costs, to reduce the loss of time during operations and to require only a minimum amount of repairs.

The proper design, durable construction, and built-in safety features all insure uninterrupted operation. You can secure maximum output together with the lowest cost by using Torchweld Equipment.

Dependability

use

TORCHWELD

The Standard of Comparison

GET THE FACTS. Write for Catalog No. 26.

TORCHWELD EQUIPMENT COMPANY
226 N. Carpenter St. CHICAGO

Steel Sales Welding Rods

A Welding Rod for Every Job

Gas NORWELD Welding

Norweld, one of our leading rods, is a copper coated, low carbon soft wire for acetylene welding; uniform in quality; recommended for welding of wrought iron, steel, tanks, boiler plate, sheets, angles, flues, etc., where higher tensile strength is required.

Other rods carried in our Chicago stock for immediate shipment are:

Wilson Color-tipt	E†	Elecweld special	E
Norweld Special	A*	Elecweld	E
Norweld	A	Steelweld	E
Castweld	A	Vanadweld	A&E
Bronzeweld	A	Hicarweld	A&E
Nickelweld	A&E	High Manganese	A&E

*Acetylene †Electric

Write for The Welder's Guide, a Practical Book on Welding

129 S. Jefferson St.
Chicago, Ill.

STEEL SALES CORPORATION

J. A. Roesch, Jr., Pres.
F. W. Walters, V. Pres.
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Steel, Monel Metal, Nickel, Brass, Copper, Copperweld, Nickel Silver, Phosphor Bronze, Nickel Zinc.

When buying CARBIDE — Ask for NATIONAL

BEST for All Industrial Purposes

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IN THE RED DRUM SAVES YOU MONEY

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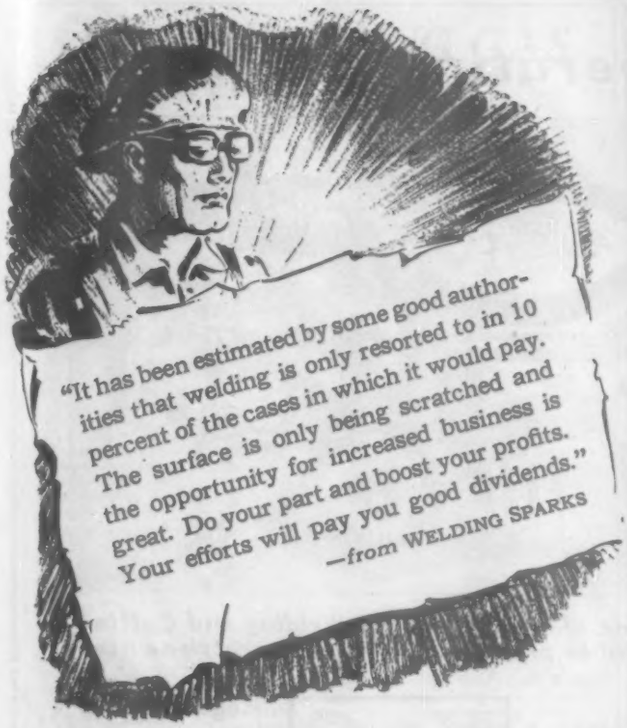
Warehouses in All the Principal Cities

National Carbide Sales Corporation, 342 Madison Ave., N. Y.


"It has been estimated by some good authorities that welding is only resorted to in 10 percent of the cases in which it would pay. The surface is only being scratched and the opportunity for increased business is great. Do your part and boost your profits. Your efforts will pay you good dividends."
—from WELDING SPARKS

Better Welds Will Boost Welding Business 90%

Welding is a comparatively new process. It is used today in ONLY one place in ten where it could be profitably employed, according to authorities.

It is of vital importance to the industry to get this additional 90 per cent of business that logically belongs to it.

Nothing is more important than good workmanship in accomplishing this result. Our part, as we see it, is to furnish uniformly fine materials—materials that assure better welds every time.

That is the reason each Page Welding Wire or Electrode is plainly marked, carefully processed and then proved by an actual shop test. Prove Page quality for yourself. We'll gladly furnish samples.

PAGE STEEL *and* WIRE COMPANY

Bridgeport, Connecticut

An Associate Company of the American Chain Company, Incorporated

District Offices:

Chicago New York Pittsburgh San Francisco

PAGE-ARMCO

PROCESSED

Welding Wire *and* Electrodes

Uniform Quality Assured

WELDERS who use Commercial Acetylene soon learn that every cylinder contains the same pure gas.

Your torch can tell the difference!

COMMERCIAL ACETYLENE
Means pure acetylene.

COMMERCIAL SERVICE
Means prompt service.

No matter what your gas requirements may be you will be interested in our sales plan. Ask our nearest office to tell you about it.

Supplied in the following size cylinders:

10x30-in. size	125 cu. ft. cap.
12x36-in. size	225 cu. ft. cap.
12x44-in. size	275 cu. ft. cap.

Commercial Acetylene Supply Company, Inc.

General Office: 71 Broadway
New York City

BRANCHES:

600 W. Jackson Blvd.
Chicago, Ill.

613 Trust Co. of Georgia Bldg.
Atlanta, Ga.

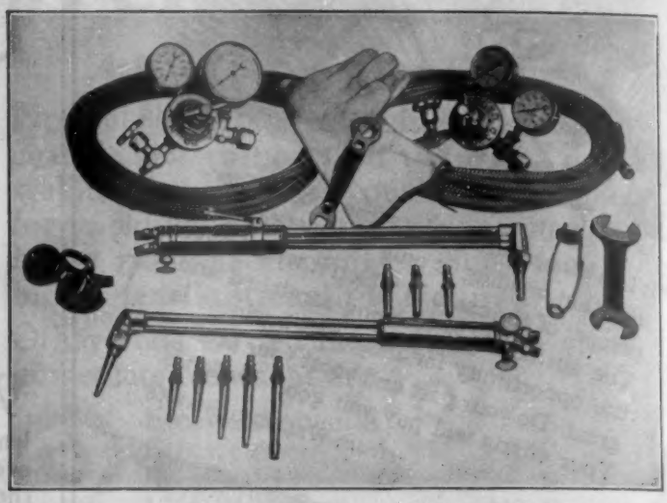
683 Atlantic Ave.
Boston, Mass.

417 Market Street
San Francisco, Calif.

Under the severest operating conditions

you can depend upon K-G Apparatus

By making them simple, substituting scientific accuracy of gas mixture for intricate design, we have produced a line of torches which are perfectly safe, economical to use, and 100% efficient. They cost no more, because we just make them better, not more expensive.



Order one of these complete Welding and Cutting Units and be prepared for every oxy-acetylene need

K-G WELDING & CUTTING CO. INC.
515 West 29th St.
Phone: Chickering 0996-7-8
New York City

Welding Torches
Cutting Torches
K-G
Regulators Supplies
Complete Units

Bronze welding has been made faster, better, and more uniform with

"KORO"
(Patent applied for)

TOBIN BRONZE WELDING ROD

The development of this new rod has resulted in an entirely new procedure for bronze welding, a procedure which saves time and gas, and gives a more satisfactory result. Our new booklet, "A New Method of Bronze Welding," just off the press, tells the whole story. Send for your copy.

We make a complete line of gas and electric welding wires for every class of work.

KORO CORPORATION
WAUKEGAN, ILLINOIS
(Formerly LINCOLN STEEL CO., CHICAGO)

Dealers:
Our agency proposition is exceptional and we have several good territories open. Write for details.

MODEL "O"

has been designed to give the welder a maximum of comfort and protection embodied in the extreme lightness of weight, proper ventilation and the absolute exclusion of all outside light.

MODEL "O"

is made throughout of special vulcanized fibre of exceptional strength and wearing qualities. This shield carries the CESCO indorsement; your assurance that the degree of quality and workmanship is of the highest.

Model "O" Handshield

PRICE

Complete with ESSENTIALITE Lens
$5.00 *each.*

Manufactured by

Chicago Eye Shield Company
2300 Warren Ave., Chicago, Ill.

STOP WASTING GAS
WELDIT GASAVER

can reduce your gas consumption 25%

PREVENTS burning gas while torch is idle. Hang torch on hook and flame goes out. To start again, simply pass torch tip over pilot light, and obtain the pre-adjusted flame. No time or gas is lost in getting started. **Automatic check valve keeps flashbacks from reaching hose or regulators.**

Easily attached to all makes of portable and stationary outfits.

Approved by
National Board of Underwriters
Licensed Under Basic Patents

WELD IT WITH WELDIT EQUIPMENT SUPPLIES

Welding Torches	Cast Iron Rods
Cutting Torches	Welding Hose
Regulators	Brazing Wire
Lead Burning Equipment	Fluxes & Solders
Welding Wire	Safety Gloves
Welding Goggles	Service

WELDIT ACETYLENE CO.
634 Bagley Ave. DETROIT, MICH.

Big Jim (Master Welder) *says:*

I used to think I could make just as good a weld whether my welding bar was square, round or flat. But I know different now. It's square bars for me from now on—square FRE-FLO bars. They sure know how to make 'em. Not a trace of bur or fin—no place for grains of sand to stick. And that means a *clean weld* every time.

[Want a sample of FRE-FLO? Just drop us a postcard.]

Big Jim (MASTER WELDER)

FRE-FLO rods are sold only through distributors. A few desirable territories are still open. Correspondence from distributors is invited.

The Atlas Foundry Company
Department "B"
W. 69th & W. & L. E. Ry. Cleveland, O.

Flexibility!

Adjustable features that enable the operator to use all grades of electrodes, both coated and bare, are built into the USL electric arc welder. With the great number of electrodes on the market today, the advantages of such flexibility are evident.

There is no USL welder ever built, so far as we know, which is not still in operation. Add to this the proven operating economy of USL,—its consistent, dependable performance, —and you can see why USL arc welder sales have increased more than 2800% during the last nine years.

Your business deserves the best. If you want the best, you want USL.

Important Message to Distributors!

The tremendous increase in USL arc welder sales has brought big profits to USL distributors. Get your share of these profits! Write us today for details of the USL distributing proposition.

USL Battery Corporation, Niagara Falls, N. Y.

USL
ELECTRIC ARC WELDER

An Indispensable Federal Welder in a large metal stamping plant

This heavy duty Federal Spot Welder is kept busy in a mammoth metal stamping plant, in the assembling of the reinforcing rings on rear axle housings. It is equipped with water-cooled transformer and conductors, and has proved an important factor in speeding up production in this busy plant.

This is another example of an extended and successful study of a perplexing automotive problem, made by Federal Engineers. This Federal Welder has become an important link in meeting production schedules in this particular plant.

What has been accomplished for one manufacturer can as easily be done for you. Let us show you how.

Federal
Machine & Welder Co.
Warren, Ohio, U. S. A.

Federal Spot Welders are the Most Universally Used Tools of their kind

Welding Rods for Every Purpose

WILSON

ELECTRIC ARC WELDING WIRE

WILLIAMS

Weldflo

WELDING WIRE

ELECTRIC and GAS WELDING WIRE

High-Grade
Low-Priced
Guaranteed Analysis
Absolute Uniformity

Immediate Shipment from Warehouse

Send for samples of the new Weldflo wire

WILLIAMS & COMPANY, INC.
WELDING SUPPLIES
925-935 Pennsylvania Avenue, Pittsburgh, Penna.

"Note the name Weldflo *Each rod the same"*

Representing: TORCHWELD EQUIPMENT CO.

A Reputation for Continuous Service

is making the

NEW IMPROVED

SENECA Electric ARC WELDER

the most popular in the field

Simplicity of design, rugged construction, no repairs, explain the dependability of the Seneca Arc Welder. This machine is capable of handling a large volume of work, small jobs and big jobs. It is built for all around service. Payment can be arranged on convenient terms if desired. Get yourself a Seneca. It will soon pay back its cost.

Seneca Electric Arc Welder Co.
Seneca, Kansas

SOS Welding Corp.

Engineers—Contractors

WELDED

PIPE, TANK AND STEEL CONSTRUCTION

For many years the S O S Welding Corporation has been successfully serving the largest industrial, public utility, and shipbuilding concerns from coast to coast. May we serve you in your next important and difficult welding operation?

Specialists in Important Welding Operations
From Coast to Coast

502 Hamilton Ave., Brooklyn, N. Y.
(Telephones Hugenot 1920, 1929)

For UNDERWATER CUTTING
The Ellsberg Torch, Model "S-51"
(Patent Pending)
Using Oxygen, Hydrogen and Compressed Air

Any Thickness — Any Depth
ANYWHERE
Complete Units and Skilled Operators
By the Day or on contract
Prompt Service—Reasonable Rates

CRAFTSWELD EQUIPMENT CORP.
Manufacturers
570 Seventh Ave. New York, N. Y.

300 to 450 Amperes Welding Current

Plenty of Welding Current for faster and better welding is available with UNA Welders.

Made in two types as follows:
Type A3 ..... 75 to 300 amperes
Type A4 .....100 to 450 amperes

With a current range of 75 to 450 amperes, the welding operator can tackle any welding job from thin steel sections to heavy structural steels and castings.

UNA Welders are available for either carbon arc or metal arc welding depending on the job. They are compact, rugged, portable and easily moved to the job if necessary.

Send for new Bulletins on Una Welders and Welding Rods.

UNA Incorporated
1617 COLLAMER AVE., CLEVELAND, OHIO

UNA Welders Welding Rods

How Do Your Cylinder Records Compare With These?

In a series of gas discharging tests a Hackney Acetylene Cylinder required only 33 pounds of acetone for an average of 18.75 pounds of gas charged. Its discharging time averaged 6½ hours.

That is the kind of performance that is helping Hackney Cylinders take the "high" out of acetylene costs. It means lower charging costs for the producer, more value per cylinder for the user, and the smallest possible amount of inaccessible gas.

This can be directly attributed to the exceptional value of Hackney's filler. Many Hackney Cylinders have records of from 100 to 200 fillings each—and still their cores show no signs of deterioration, no sagging and no breaking down of the structure.

In addition, Hackney Cylinders are built to last. 99 7/10% of all those manufactured in the last 16 years are in active service today. Such a record speaks for itself.

Compare the records of your cylinders with Hackney's. Then write us the result. We may be able to show you how to save money.

PRESSED STEEL TANK COMPANY

MILWAUKEE, WISCONSIN

1155 Continental Bank Bldg., Chicago, Ill.
1331 Vanderbilt Concourse, New York City
5731 Greenfield Ave., Milwaukee, Wisconsin

IDEAL FACE SHIELDS

Ideal Face Shields protect the head, chest and neck against direct and reflected rays. Easily adjusted and removed. Constructed of vulcanized fibre and aluminum, assuring durability and lightness. Hinged door allows quick inspection of work or interchange of glasses.

IDEAL WELDING GLOVE

The Ideal Glove for Electric and Acetylene Welders is made from Sheep Skin, which has been Subjected to an Asbestos Treatment and which makes it both heat resisting and fireproof.

IDEAL WELDING APRON

The Ideal Apron for Welders is made of leather which has been especially treated to stand the heat, and at the same time be very flexible and durable.

THE IDEAL FACE SHIELD CO.

468 N. Garfield Ave.,
COLUMBUS, OHIO

DON'T STRIKE A MATCH

SHOOT-A-LITE

See the safe distance of hand from flame

SAFE!
SURE!!
STRONG!!!

The finest torch lighting device ever made. Try it.

STEVENSON DISTRIBUTING CORPORATION
(Sole Owner)

119-121 E. 27th St., New York City

More Welds at lower cost

Burke Variable Voltage Welder

In addition to the single operator type of welder we build a two-operator machine which is distinctively a Burke development.

Either operator can regulate for his own requirements without affecting the other and may use any proportion of the capacity of the welder as long as their total demands are not greater than the rated output of the machine.

The results are self evident—greater production, flexibility and lower cost per weld.

Bulletin No. 133 gives complete description and superior features. *Write for it.*

BURKE ELECTRIC COMPANY
ERIE, PA.

Service Sales Offices:

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH
CLEVELAND DETROIT BUFFALO

Sales Agencies:

AKRON — Berthold Elec. & Eng. Co.
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ST. LOUIS — Louis D. Moore
TROY, N. Y. — E. I. Van Doren
TULSA — Cost Cutting Co.

Willson Electric Welding Helmet No. 200

For all kinds of electric welding. Equipped with Willson-Weld Glass, —cuts out over 99% of the injurious rays. Prevents distorted vision and sandy eyes. No. 200 helmet complete, $12.60, f. o. b. any Willson distributor, or from

WILLSON GOGGLES, INC.
READING, PA.

Dixon's Graphite Rods and Plates for Welding

Made in all diameters, lengths and sizes.

Small diameter rods are sold in 4, 6 and 8 inch lengths, the shorter the rod the less breakage in shipping.

Also Dixon's Graphite Welding Putty. In 5 and 10 lb. cans.

Dept. 202A.

Joseph Dixon Crucible Co.
JERSEY CITY, N. J.
1827— ONE HUNDREDTH ANNIVERSARY —1927

INDUSTRIAL GASES

OXYGEN HYDROGEN
ACETYLENE NITROGEN

ALSO GENERATING APPARATUS

Cylinders—Valves—Regulators
Eyosee and International Welding and Cutting Torches
Welding Wire—Fluxes
Cast-iron and Aluminum Rods
Plain and Armored Rubber Hose
Asbestos Pads and Paper Goggles, etc.

All equipment fully guaranteed
Quick shipment and low prices

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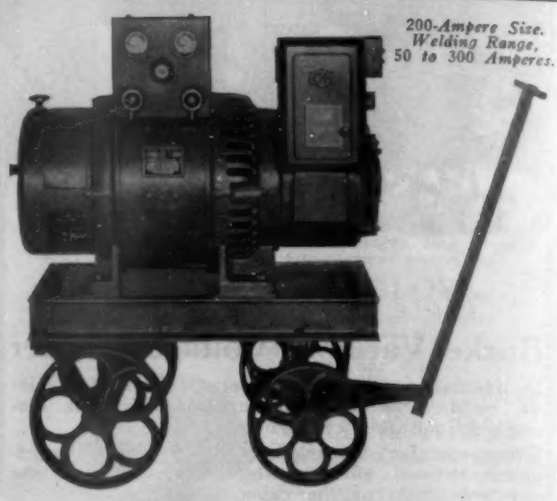

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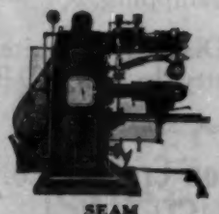

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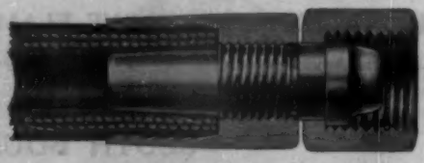

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Fig. 3—Showing punch press projections which locate spot welds

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Fig. 2—Dark spots show 6 welds made simultaneously

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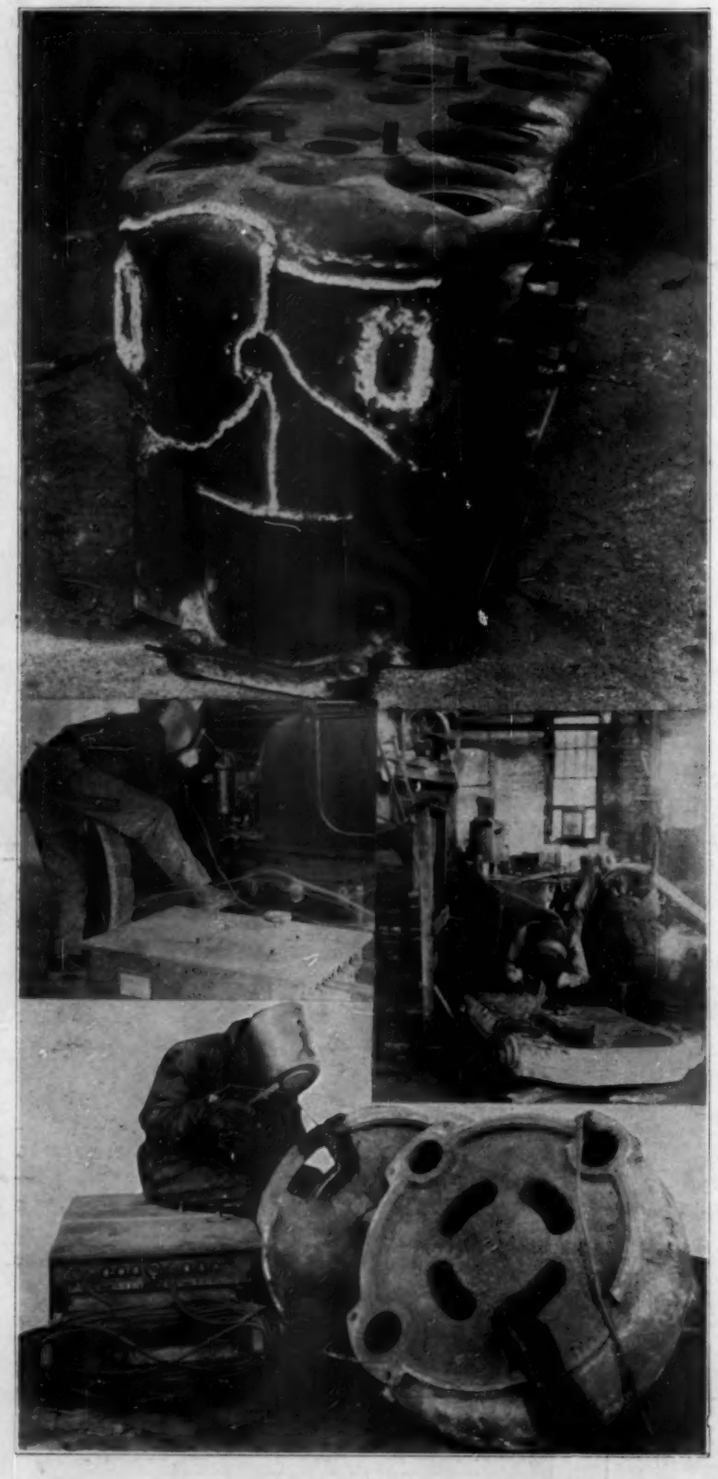

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